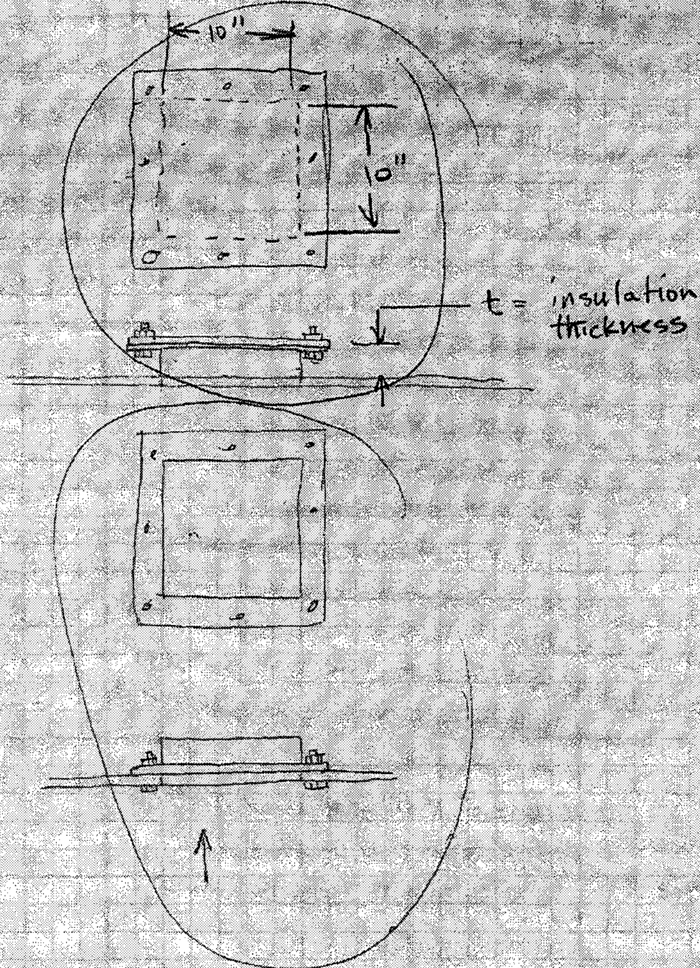

10"
10"
t = insulation thickness

From: Ken Nielson
To: fpalacios@bbpwr.com
Date: 2/4/2003 5:37 PM
Subject: OFA Project - Intermountain Power

Francisco,

Thank you for the drawing package sent last week. It has been most helpful. In trying to tie up loose ends, there are a few questions still remaining. I have tried to provide an inclusive list below.

1) We still need a detailed layout drawing of the common junction boxes/cabinets in order to specify terminal block points for wiring coming to and from the combustion control system and the OFA system.

2) A review of the OFA construction drawings last week did not show the location of these junction boxes on the 9th floor. We need this in order to finish routing specifications for power and instrumentation wiring. Please send a drawing showing this or a reference to a drawing that we may have already received.

3) The drives specified by BPI for the dampers were models SM-5120 and SM-5220. Will these be the models SM-5120N and SM-5220N or SM-5120D and SM-5220D? Towards this same end, please provide a list of all the options specified for the drives. We also need drawings showing how the drives are to be wired to and from the JBXs.

4) Position feedback from the drives to the combustion control system (CCS) was required as were remotely located drive amplifiers. Will the drives include two (2) separate VRs and 4-20mA transmitters (one set for CCS and one set for the drive amplifiers) or will it be possible to use the same signal for both the CCS and drive amplifier? (If one signal is planned, we estimate that it must be capable of handling a minimum impedance of 500 ohms.)

5) Which amplifier will be provided for the drives? Drawings of how these are to be wired are also needed.

6) In reviewing the drawings that show the location of the Air Monitor CAMS system, the boiler front and back duct sizes are different. Will this create any problems from with calibration of the CAMS system or bias settings on the secondary air system? (James Nelson said that BPI had made a point of saying that 64 sq.ft. was the minimum allowable cross-sectional area on the feeder ducts, hence we wondered if the difference is significant from either a performance or tuning perspective.)

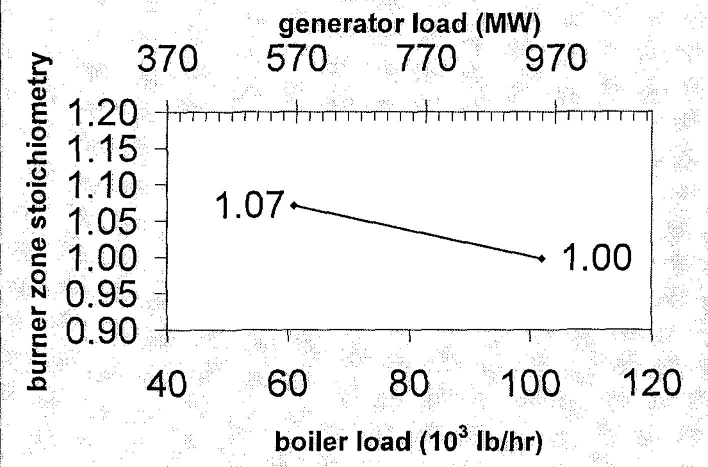
7) A question of spare parts has come up. For which OFA instrument and control components will spares be provided and in what quantities? Also, please provide a complete list or bill of materials of all instrument and controls equipment and replaceable components with a recommended level of spares for each.

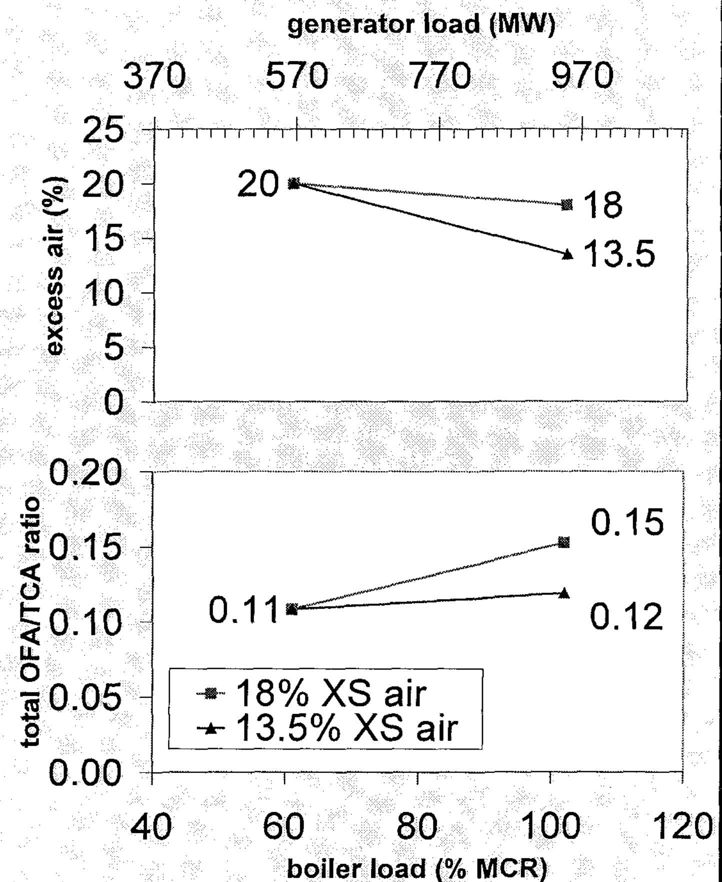
Please contact me if you have questions or concerns with this request. As it will be important to get this information as soon as possible, I will try to contact you by phone tomorrow.
Thanks,

Kenneth M. Nielson, P.E.
Lead Engineer, Technical Services
Intermountain Power
Delta, UT 84624
(435) 864-6437
kenneth-n@ipsc.com

Babcock Power Inc.

Preliminary OFA Ratio Control Curve





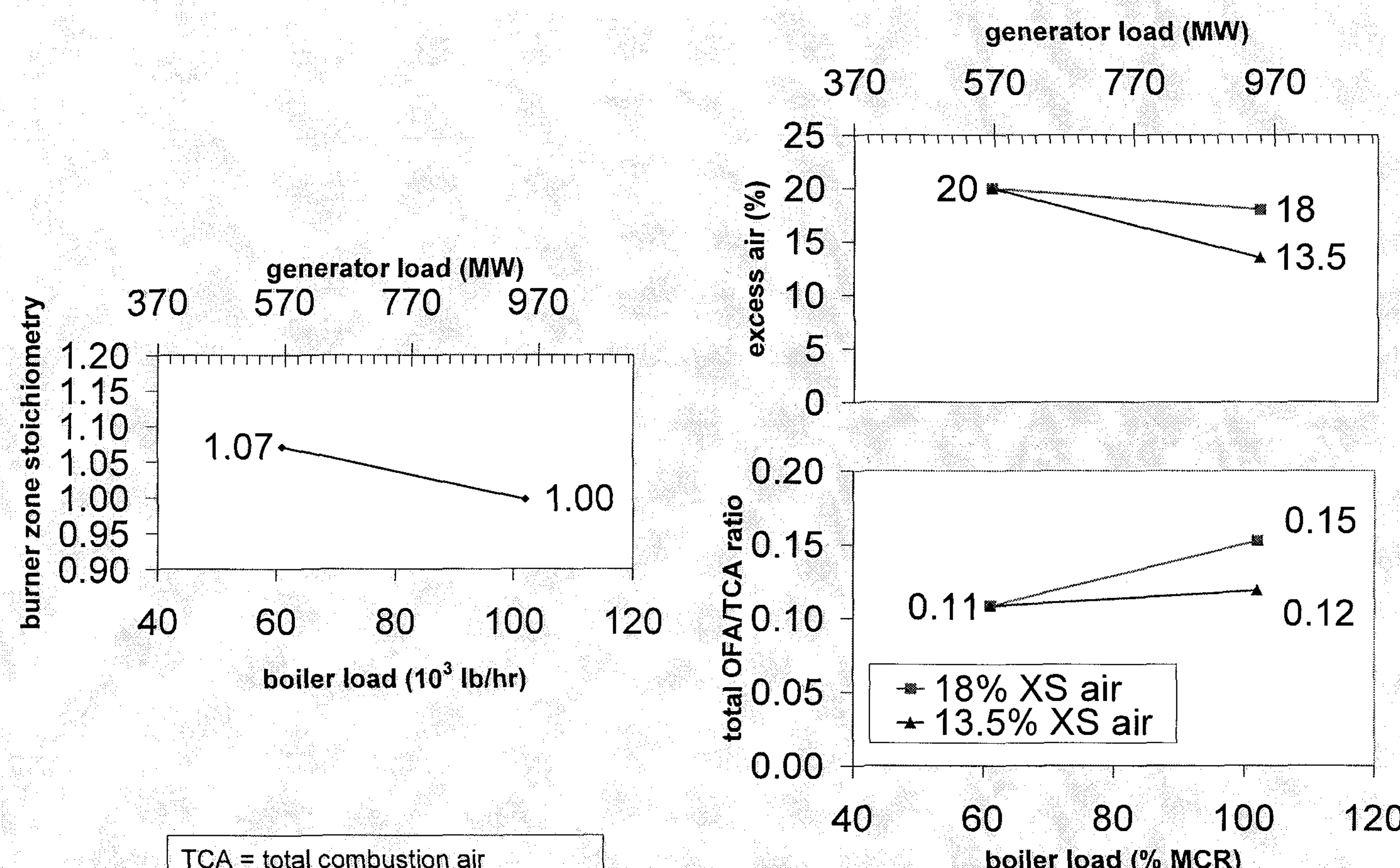
TCA = total combustion air

Babcock Power Inc.

IP7_040092

Babcock Power Inc.

Preliminary OFA Ratio Control Curve



TCA = total combustion air

Babcock Power Inc.

IP7_040093

From: Ken Nielson
To: fpalacios@bbpwr.com
CC: Bill Morgan; James Nelson
Date: 2/11/2003 5:02 PM
Subject: OFA System - Intermountain Power

Francisco:
Following my voice mail to you of this afternoon (3:30 MST), I have had a few additional questions surface. My apologies, but we are throwing the questions to you as quickly as we can review the drawings and documentation. The questions are as follows:

1) Slide links in the Junction Box/Enclosure (mentioned in my voice mail to you). Our typical standard and preference has been to use slide links rather than fixed/bolt down links. These appear to be DIN rail mounted. Can they be changed to slide links? We can provide spec details on the links if required.

2) Enclosure size. The specificed enclosure for the drives seems very small (approx. 24"x24"x7.3"). This is especially true when considered with the quantity of cables that will be going in and out of this cabinet. There is, and should be after installation of the OFA ducts, plenty of space for a larger cabinet that would facilitate installation and maintenance of the wiring and equipment. At present, I have concerns about getting all the wiring into these cabinets.

3) Jordan Drive Amplifier Operating Temperature. What are the recommended and maximum allowable ambient operating temperatures for the AD-8230? I could not find an indication of the operating temperature limitations on the AD-8230 amplifier. (Heat concerns are why remote mounting of the amplifiers is required.)

4) The spec sheets and the Jordan drawings indicate in large letters not to exceed a 50' maximum distance between the amplifiers and the drives. Based on the drawings provided, four (4) of the six drives will be located in excess of 50' from the cabinet when wiring and conduit distances are taken into consideration.

5) Position of the Feeder Duct Damper Drive. The Feeder duct damper drives are mounted on the boiler side and above the OFA duct. This seems to complicate the access to these drives for wiring, maintenance, etc. It also increases the distance from the JBX and the amplifiers. Is there a reason that these cannot be mounted lower and on the outer side of the OFA ducts?

Please call me if there are concerns or questions on these items.
Thank you

Kenneth M. Nielson, P.E.
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kenneth-n@ipsc.com

From: Ken Nielson
To: jgielda@babcockpower.com
Date: 2/6/2004 6:10 PM
Subject: OFA Test Ports
Attachments: PORT PLACEMENT.dwg

Jerry,
The attached drawing shows the dimensions and side of the duct where the test ports are located. The drawn position and size of the ports is only representative and not to actual scale.

Test ports should be of at least 2" ID pipe with coarse threaded caps.

The north side ports are located 24" upstream from where the Feeder duct opens into the OFA header (just upstream of the location of the flow elements). According to the prints, the duct is 77" in height at this point. This is probably as far upstream in any parallel section of the feeder duct as they can be placed due to duct geometry and obstructions. While ideally it would have been better to have them upstream in the longer segment of the feeder duct that is not converging or diverging, access to the ports in that area is obstructed by a variety of building structural elements.

The south side ports are located on the inner (or north) side of the south feeder ducts due to obstructions from the south or front side. They are located on the feeder duct approximately 25" upstream from where the diagonal section of the feeder duct straightens back into the OFA header. They cannot be placed further down stream due to access obstructions when trying to insert or extract the traverse probes. They could be moved a few inches upstream and improve access with the probes without encountering access problems.

This drawing does show the approximate location of the flow elements. The ideal location for both the access ports and the flow elements is at the end of the longest parallel section of the feeder duct.

I hope this helps. Contact me if questions.
Thanks,
Ken Nielson

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Intermountain Power Service Corporation
Over Fire Air System – IGS02-14
Controls Test Plan

Introduction

The following plan is designed to test the performance and operation of the new Over Fire Air (OFA) system installed on Unit #1 of the Intermountain Generating Station (IGS).

Objectives:

1) Validate operational capabilities of the OFA system
   a) Verify proper operation of OFA final control elements.
   b) Validate operation and accuracy of OFA instrumentation.
   c) Tune damper control through variable load ranges.
2) Validate performance capabilities of the OFA system.
   a) Verify emissions levels for NOx, CO, and unburned carbon at multiple loads, different fuel quality, and variable configurations of pulverizers in service.
   b) Verify air flows a multiple loads with variable configurations of pulverizers in service.
   c) Verify proper OFA system performance at high temperature and identify required cooling flows When OFA is out of service.
3) Restraints:
   a) Overfire Air flow will be limited to a maximum of 10% of total combustion air flow.

Testing Phases & Schedule

1) Phase 1 – Pre-operation testing: Mar. 27, 28, & 29
   Conducted off-line, prior to start-up, without air flow.
   a) Local Manual damper stroking test.
   b) Wiring validation.
   c) Motorized damper stroking test (manually initiated).
   d) Motorized damper stroking test (automatic mode with simulated inputs).

2) Phase 2 –OFA system operational testing: Apr. 1 & 2 - Conducted on-line, at temperature, and at different loads to verify proper OFA controls and mechanical operation.
   a) Test components:
      i) OFA port, inlet, and total air flow tests.
      ii) Measure port temperatures
      iii) Manually bias Secondary Air (SA) damper position control.
   b) Tests:

Test #	Description	Load Required	1/3 Dmpr. Position	2/3 Dmpr. Position	Inlet Dmpr. Position
1	Initial Conditions Test	550 MW	CLOSED	CLOSED	CLOSED
2	60-75% Load Test	a) 600 MW b) 700 MW	OPEN	CLOSED	OPEN
3	75-90 % Load Test	a) 725 MW b) 850 MW	CLOSED	OPEN	OPEN
4	90-Full Load Test	a) 875 MW b) 950 MW	OPEN	OPEN	OPEN

   c) Implement necessary mechanical and control corrections.

Intermountain Power Service Corporation
Over Fire Air System – IGS02-14
Controls Test Plan

3) Phase 3 – Performance testing: 1st Test Set (Typical Fuel Quality): April 7, 8, & 9;
2nd Test Set (Worst Case Fuel Quality) April 23 & 24.

Phase 3 tests are to be conducted on-line, at temperature, at different loads, with different fuel and mill configurations to verify NOx, CO, and unburned carbon control and adjust controls trim. The matrix listed below is recommended for both 1st and 2nd Test Sets.

a) Test Components
   i) Validate operational corrections – Repeat of Phase 2 test with controls in auto.
   ii) Measure and verify that NOx, CO, and unburned carbon levels are within guarantees at each load set.
   iii) At each load level, change mill configuration and verify operational and performance guarantees.
   iv) Test Set 1 to be completed with typical fuel blend.
   v) Test Set 2 to be completed with worst-case fuel blend in terms of slagging, fouling, and intrinsic sulfur, nitrogen, and non-combustibles content.
   vi) The duration of each test is dependent upon time required to stabilize unit operation following load, mill configuration, and OFA port positions changes.

b) Test Matrix:

IPSC OFA Performance Test Matrix										
Test #	Test Range	Generator Load Set	Test date & Duration	Operational Parameter Requirements:	Mills in Service		OFA Port Dmpr Pos.			Data to record
					Front	Back	1/3	2/3	Inlet	
1	60%	600 MW	4/7 – 2 hr	Per Contract	FAE	GC D	OPN	CLS	OPN	All
2	to		4/7 – 2 hr	requirements:	BFA	GC D				
3	75%	700 MW	4/7 – 2 hr	12.a - f, 12.k-n, 12.q.	BFA	GCH	OPN	CLS	OPN	All
4			4/7 – 2 hr	Fuel: as listed above.	FAE	CHD				
5	75% to	750 MW	4/8 – 2 hr	Per Contract	FAE	CHD	CLS	OPN	OPN	All
6	90%		4/8 – 2 hr	requirements:	BFA	GCH				
7		850 MW	4/8 – 2 hr	12.a - f, 12.k-n, 12.q.	BFA	GCHD	CLS	OPN	OPN	All
8			4/8 – 2 hr	Fuel: as listed above.	FAE	GCHD				
9	90%	875 MW	4/9 – 2 hr	Per Contract	FAE	GCHD	OPN	OPN	OPN	All
10	to		4/9 – 2 hr	requirements:	BFAE	GCH				
11	Full	950 MW	4/9 – 2 hr	12.a-h, 12.k-n, 12.q.	BFAE	GCH	OPN	OPN	OPN	All
12	Load		4/9 – 2 hr	Fuel: as listed above.	BFAE	GCHD				

BR = burner data
B = boiler data
G= gas analysis grid data
FO = furnace observations
FA = fly ash sample
FL = fuel sample

Intermountain Power Service Corporation
Over Fire Air System – IGS02-14
Controls Test Plan

PRELIMINARY OPTIMIZATION TEST MATRIX
INTERMOUNTAIN POWER UNIT 2 (100210)

Test #	Main Steam Flow (10^3 lb/hr)	Boiler Load (% MCR)	Approx. Generator Load (MWg)	Excess Air (%)	Target Total OFA Flow (10^3 lb/hr)	Approx. Burner Zone Stoich., SR_B	Maximum Allowable OFA Flow for SR_B = 0.95 (10^3 lb/hr)	OFA Damper(s) Open	Mill Out of Service	Data [1]
1	6,285	95	900	18	1,100	1.0	1,400	1/3 & 2/3	G	All
2				16	980		1,280			BR, B, G, FO, FA
3				13.5	825		1,125			
4	5,940	90	850	16	925		1,190			
5	4,950	75	710	18	550	1.06	1,090	2/3		
6	4,055	61	575	20	220	1.15	970	1/3		
7	6,750	102	950	16	1,040	1.0	1,360	1/3 & 2/3		All
8	6,285	95	900		optimum	optimum	1,280			BR, B, G, FO, FA
9	4,055	61	575	20			970	1/3		All
10	6,750	102	950	16			1,360	1/3 & 2/3	E	
11	6,285	95	900	18			1,400			BR, B, G, FO, FA
12				16			1,280			
13				13.5			1,125			
14	5,940	90	850	16			1,190			
15	4,950	75	710	18			1,090	2/3		
16	4,055	61	575	20			970	1/3		All

BR = burner data
B = boiler data
G= gas analysis grid data
FO = furnace observations
FA = fly ash sample
FL = fuel sample

From: Ken Nielson
To: Aaron Nissen; Bill Morgan
Date: 3/25/2003 2:34 PM
Subject: OFA Testing Plan
Attachments: OFA Test Procedure.doc

Check this over and let's discuss further.
thanks,
Ken

From: Dan Beistel <dbeistel@airmonitor.com>
To: <kenneth-n@ipsc.com>
Date: 4/7/2003 8:42 PM
Subject: OFA Traverse
Attachments: OFA Trverse Worksheet.xls

Ken,

Here are the results for the OFA test. Ken the f-factor may have changed a bit on the SE, enter the numbers in the K-Factor sheet.

If you have any questions give me a call or e-mail me. Also I hope the temps. are ok you may want to double check.

3D PROBE WORK SHEET

PROJECT:--- **Inter-Mountain** **OFA NE**
Date:.... **4/2/2003**
Load:...... **Damper 1/3**

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		651				
AVERAGE PRESSURE IN. W.C. (Pg)		2.65				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.20	25.20	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	21.17	19.58	
ACTUAL STACK VOLUME (Q acfm) =	81,504	75,374	-7.52
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	32,618	30,164	-7.52
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	32,618	30,164	-7.52
FLOW IN LBS/HR (wet) =	147039	135977	-7.52
FLOW IN LBS/HR (dry) =	147039	135977	-7.52

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.030068
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

<date>

Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In. W.C.	P23-Patm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.033	-13.00	651	0.007	0.000	2.39	2.49	-0.005	-0.000	2.39	2.51	0.000	-0.424	0.974	0.007	13.01	8.49
	2	0.032	0.00	651	0.023	0.000	2.43	2.51	-0.005	-0.000	2.43	2.52	0.000	-0.424	0.974	0.022	0.42	15.79
	3	0.033	-3.00	651	0.036	0.000	2.49	2.55	-0.005	-0.000	2.49	2.56	0.000	-0.424	0.974	0.035	3.03	19.73
	4	0.031	-10.00	651	0.058	0.000	2.47	2.52	-0.005	-0.000	2.47	2.53	0.000	-0.424	0.974	0.057	10.01	24.70
	5	0.034	-5.00	651	0.063	0.000	2.61	2.65	-0.005	-0.000	2.61	2.66	0.000	-0.424	0.974	0.061	5.02	26.03
	6	0.036	3.00	651	0.070	-0.054	2.53	2.57	0.000	0.000	2.53	2.58	-0.771	-19.073	1.022	0.072	19.30	26.63
	7	0.031	13.00	651	0.071	-0.025	2.63	2.67	-0.001	-0.000	2.63	2.68	-0.352	-22.902	1.047	0.074	26.16	25.81
2	1	0.036	-4.00	651	0.003	-0.002	2.40	2.50	0.000	0.000	2.40	2.52	-0.667	-17.951	1.016	0.003	18.38	5.53
	2	0.032	0.00	651	0.003	0.000	2.40	2.50	-0.005	-0.000	2.40	2.52	0.000	-0.424	0.974	0.003	0.42	5.70
	3	0.034	-2.00	651	0.004	0.000	2.33	2.43	-0.005	-0.000	2.33	2.45	0.000	-0.424	0.974	0.004	2.04	6.58
	4	0.031	7.00	651	0.011	-0.004	2.37	2.47	-0.001	-0.000	2.37	2.49	-0.364	-23.697	1.053	0.012	24.65	10.32
	5	0.038	15.00	651	0.022	-0.008	2.41	2.49	-0.001	-0.000	2.41	2.50	-0.364	-23.697	1.053	0.023	27.81	14.20
	6	0.035	15.00	651	0.044	-0.014	2.41	2.47	-0.000	-0.000	2.41	2.48	-0.318	-20.603	1.031	0.045	25.29	20.31
	7	0.036	20.00	651	0.078	-0.020	2.56	2.58	0.001	0.000	2.56	2.58	-0.256	-16.758	1.011	0.079	25.87	26.66
3	1	0.035	3.00	651	0.011	0.006	2.54	2.63	-0.013	-0.000	2.54	2.65	0.545	37.807	1.259	0.014	37.91	9.80
	2	0.032	13.00	651	0.011	0.002	2.52	2.62	-0.011	-0.000	2.52	2.64	0.182	14.925	0.992	0.011	19.70	10.38
	3	0.036	7.00	651	0.011	0.002	2.55	2.64	-0.011	-0.000	2.55	2.66	0.182	14.925	0.992	0.011	16.45	10.57
	4	0.034	7.00	651	0.022	0.004	2.56	2.64	-0.011	-0.000	2.56	2.65	0.182	14.925	0.992	0.022	16.45	14.95
	5	0.035	6.00	651	0.025	0.009	2.50	2.58	-0.010	-0.000	2.50	2.59	0.360	21.217	1.024	0.026	22.01	15.65
	6	0.033	11.00	651	0.026	0.006	2.55	2.63	-0.010	-0.000	2.55	2.64	0.231	17.737	1.004	0.026	20.78	15.93
	7	0.032	23.00	651	0.033	0.001	2.66	2.73	-0.006	-0.000	2.66	2.74	0.030	2.200	0.973	0.032	23.10	17.38
4	1	0.034	-18.00	651	0.071	-0.005	2.64	2.67	-0.002	-0.000	2.64	2.68	-0.070	-5.882	0.981	0.070	18.91	26.34
	2	0.034	-25.00	651	0.014	0.004	2.67	2.76	-0.010	-0.000	2.67	2.78	0.286	19.742	1.014	0.014	31.46	10.72
	3	0.034	-4.00	651	0.010	0.003	2.68	2.77	-0.010	-0.000	2.68	2.79	0.300	20.092	1.017	0.010	20.47	9.96
	4	0.035	0.00	651	0.013	0.001	2.58	2.67	-0.009	-0.000	2.58	2.69	0.077	6.382	0.974	0.013	6.38	11.80
	5	0.036	-3.00	651	0.021	0.000	2.62	2.70	-0.005	-0.000	2.62	2.71	0.000	-0.424	0.974	0.020	3.03	15.07
	6	0.037	0.00	651	0.025	-0.003	2.63	2.70	-0.000	-0.000	2.63	2.71	-0.120	-9.109	0.988	0.025	9.11	16.37
	7	0.033	7.00	651	0.076	-0.007	2.72	2.74	-0.001	-0.000	2.72	2.74	-0.092	-7.353	0.984	0.075	10.14	28.39
5	1	0.036	3.00	651	0.051	-0.001	2.68	2.73	-0.004	-0.000	2.68	2.74	-0.020	-2.044	0.976	0.050	3.63	23.48
	2	0.037	1.00	651	0.068	0.002	2.59	2.62	-0.006	-0.000	2.59	2.63	0.029	2.121	0.973	0.066	2.34	27.11
	3	0.034	5.00	651	0.100	0.019	2.73	2.74	-0.011	-0.001	2.73	2.74	0.190	15.461	0.994	0.099	16.23	31.93
	4	0.032	8.00	651	0.091	0.020	2.80	2.82	-0.010	-0.001	2.80	2.82	0.220	17.191	1.001	0.091	18.91	30.11
	5	0.037	0.00	651	0.081	0.018	2.80	2.81	-0.010	-0.001	2.80	2.81	0.222	17.317	1.002	0.081	17.32	28.68
	6	0.036	1.00	651	0.062	0.016	2.65	2.69	-0.010	-0.001	2.65	2.70	0.258	18.878	1.010	0.063	18.90	24.97
	7	0.038	6.00	651	0.059	0.014	2.66	2.70	-0.010	-0.001	2.66	2.71	0.237	18.037	1.005	0.059	18.98	24.29
6	1	0.035	3.00	651	0.127	0.006	2.70	2.67	-0.007	-0.001	2.70	2.66	0.047	3.710	0.973	0.124	4.77	36.95
	2	0.036	0.00	651	0.153	0.017	2.83	2.77	-0.010	-0.001	2.83	2.76	0.111	9.409	0.978	0.150	9.41	40.25
	3	0.034	6.00	651	0.167	0.030	2.76	2.69	-0.011	-0.002	2.76	2.68	0.180	14.778	0.992	0.166	15.92	41.28
	4	0.036	2.00	651	0.157	0.038	2.86	2.80	-0.010	-0.002	2.86	2.79	0.242	18.245	1.006	0.158	18.35	39.79
	5	0.037	2.00	651	0.127	0.034	2.81	2.78	-0.010	-0.001	2.81	2.77	0.268	19.210	1.011	0.128	19.31	35.67
	6	0.035	1.00	651	0.106	0.030	2.68	2.68	-0.010	-0.001	2.68	2.68	0.283	19.669	1.014	0.107	19.69	32.56
	7	0.033	1.00	651	0.053	0.026	2.65	2.69	-0.010	-0.001	2.65	2.70	0.491	28.761	1.098	0.058	28.78	22.31

Avg. Duct Static = 2.65

	Average Temp.
Yaw Avg. =2.57	
Std. Dev. =8.97	651

		Traverse
Pitch Avg. =2.51	Result Angle Avg. =15.95	Avg. Velocity in ft/s
Std. Dev. =15.33	Std. Dev. =9.21	21.17

IP7_040102

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Probes Point Velocity
19.17
18.87
19.16
18.57
19.45
20.02
18.57
20.02
18.87
19.46
18.58
20.57
19.74
20.02
19.73
18.87
20.01
19.45
19.74
19.16
18.87
19.45
19.45
19.45
19.73
20.01
20.29
19.16
20.01
20.29
19.45
18.86
20.28
20.01
20.56
19.73
20.01
19.45
20.01
20.29
19.73
19.16

	Probes
). Velocity in ft/s	
	19.58

3D PROBE WORK SHEET

PROJECT:--- **Inter-Mountain** **OFA NE**
Date:.... **4/2/2003**
Load:...... **Damper 2/3**

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		695				
AVERAGE PRESSURE IN. W.C. (Pg)		1.92				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.14	25.14	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	32.04	30.94	
ACTUAL STACK VOLUME (Q acfm) =	123,368	119,116	-3.45
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	47,390	45,756	-3.45
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	47,390	45,756	-3.45
FLOW IN LBS/HR (wet) =	213630	206264	-3.45
FLOW IN LBS/HR (dry) =	213630	206264	-3.45

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.028861
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

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Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In. W.C.	P23-Palm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.09	-2.00	695	0.007	0	2.59	2.68	-0.005	-0.000	2.59	2.70	0.000	-0.424	0.974	0.007	2.04	8.88
	2	0.083	-9.00	695	0.012	-0.009	2.71	2.8	0.001	0.000	2.71	2.82	-0.750	-14.415	1.002	0.012	16.94	11.28
	3	0.079	-9.00	695	0.046	0	2.92	2.98	-0.005	-0.000	2.92	2.99	0.000	-0.424	0.974	0.045	9.01	22.48
	4	0.09	-4.00	695	0.097	0	2.89	2.89	-0.005	-0.000	2.89	2.89	0.000	-0.424	0.974	0.095	4.02	32.97
	5	0.086	3.00	695	0.131	-0.101	3.13	3.1	0.000	0.000	3.13	3.09	-0.771	-18.938	1.021	0.134	19.17	37.13
	6	0.088	5.00	695	0.139	-0.089	3.12	3.07	-0.002	-0.000	3.12	3.06	-0.612	-25.014	1.065	0.148	25.48	37.34
	7	0.086	17.00	695	0.143	-0.039	3.03	2.98	0.001	0.000	3.03	2.97	-0.273	-17.725	1.015	0.145	24.37	37.31
2	1	0.084	10.00	695	0.03	-0.004	2.7	2.77	-0.000	-0.000	2.70	2.78	-0.133	-9.903	0.990	0.030	14.04	17.98
	2	0.083	-5.00	695	0.022	-0.009	2.78	2.86	-0.003	-0.000	2.78	2.86	-0.409	-26.752	1.083	0.024	27.18	14.76
	3	0.082	-7.00	695	0.03	-0.018	2.83	2.9	-0.001	-0.000	2.83	2.91	-0.633	-22.367	1.043	0.031	23.38	17.45
	4	0.078	-2.00	695	0.052	-0.017	2.85	2.89	-0.000	-0.000	2.85	2.90	-0.327	-21.186	1.034	0.054	21.28	23.23
	5	0.081	-3.00	695	0.08	-0.023	2.58	2.6	0.000	0.000	2.58	2.60	-0.288	-18.630	1.020	0.082	18.86	29.07
	6	0.084	3.00	695	0.117	-0.028	2.45	2.43	0.001	0.000	2.45	2.43	-0.239	-15.777	1.007	0.118	18.11	35.10
	7	0.084	8.00	695	0.162	-0.036	2.17	2.1	0.001	0.000	2.17	2.09	-0.222	-14.824	1.004	0.163	16.80	41.55
3	1	0.084	22.00	695	0.057	0	1.95	1.98	-0.005	-0.000	1.95	1.99	0.000	-0.424	0.974	0.056	22.00	23.52
	2	0.083	-20.00	695	0.028	-0.001	1.89	1.96	-0.003	-0.000	1.89	1.97	-0.036	-3.320	0.977	0.027	20.26	16.71
	3	0.087	-13.00	695	0.027	-0.002	1.56	1.64	-0.002	-0.000	1.56	1.65	-0.074	-6.137	0.982	0.027	14.35	16.99
	4	0.085	-13.00	695	0.064	-0.007	1.61	1.65	-0.001	-0.000	1.61	1.66	-0.109	-8.457	0.987	0.063	15.47	26.08
	5	0.084	-12.00	695	0.079	-0.005	1.54	1.57	-0.002	-0.000	1.54	1.58	-0.063	-5.377	0.981	0.077	13.13	29.20
	6	0.082	-7.00	695	0.096	0.001	1.51	1.51	-0.005	-0.000	1.51	1.51	0.010	0.464	0.974	0.093	7.02	32.69
	7	0.082	7.00	695	0.163	-0.007	1.56	1.5	-0.003	-0.000	1.56	1.49	-0.043	-3.875	0.978	0.159	8.00	42.60
4	1	0.082	8.00	695	0.065	-0.006	1.26	1.3	-0.001	-0.000	1.26	1.31	-0.092	-7.366	0.984	0.064	10.86	26.77
	2	0.088	-25.00	695	0.043	-0.002	1.11	1.17	-0.003	-0.000	1.11	1.18	-0.047	-4.145	0.979	0.042	25.32	19.99
	3	0.08	-4.00	695	0.039	0	1.53	1.59	-0.005	-0.000	1.53	1.60	0.000	-0.424	0.974	0.038	4.02	20.95
	4	0.078	-5.00	695	0.063	0	1.61	1.65	-0.005	-0.000	1.61	1.66	0.000	-0.424	0.974	0.061	5.02	26.58
	5	0.075	-3.00	695	0.082	-0.002	1.54	1.56	-0.004	-0.000	1.54	1.56	-0.024	-2.428	0.976	0.080	3.86	30.41
	6	0.083	0.00	695	0.109	0.004	1.51	1.5	-0.007	-0.001	1.51	1.50	0.037	2.767	0.973	0.106	2.77	35.04
	7	0.084	-1.00	695	0.16	-0.002	1.35	1.29	-0.004	-0.001	1.35	1.28	-0.013	-1.465	0.975	0.156	1.77	42.55
5	1	0.082	6.00	695	0.159	-0.006	1.33	1.27	-0.003	-0.000	1.33	1.26	-0.038	-3.476	0.978	0.155	6.93	42.18
	2	0.082	2.00	695	0.132	0.001	1.3	1.27	-0.005	-0.001	1.30	1.26	0.008	0.220	0.974	0.129	2.01	38.61
	3	0.08	-5.00	695	0.117	0.008	1.33	1.31	-0.008	-0.001	1.33	1.31	0.068	5.613	0.974	0.114	7.51	36.06
	4	0.083	0.00	695	0.131	0.012	1.23	1.2	-0.009	-0.001	1.23	1.19	0.092	7.696	0.975	0.128	7.70	38.18
	5	0.081	-1.00	695	0.126	0.024	1.27	1.24	-0.011	-0.001	1.27	1.23	0.190	15.492	0.994	0.125	15.52	36.75
	6	0.086	5.00	695	0.12	0.021	1.26	1.24	-0.011	-0.001	1.26	1.24	0.175	14.459	0.991	0.119	15.28	35.84
	7	0.079	-6.00	695	0.095	0.022	1.29	1.3	-0.010	-0.001	1.29	1.30	0.232	17.775	1.004	0.095	18.73	31.52
6	1	0.083	3.00	695	0.268	0.001	1.63	1.45	-0.005	-0.001	1.63	1.42	0.004	-0.108	0.974	0.261	3.00	54.97
	2	0.078	0.00	695	0.248	0.012	1.9	1.75	-0.007	-0.002	1.90	1.72	0.048	3.812	0.973	0.241	3.81	52.78
	3	0.078	6.00	695	0.238	0.035	1.64	1.5	-0.010	-0.002	1.64	1.48	0.147	12.386	0.984	0.234	13.74	50.65
	4	0.078	2.00	695	0.221	0.044	1.62	1.5	-0.011	-0.002	1.62	1.48	0.199	16.027	0.996	0.220	16.15	48.56
	5	0.086	2.00	695	0.231	0.059	1.82	1.69	-0.010	-0.002	1.82	1.67	0.255	18.780	1.009	0.233	18.88	49.20
	6	0.078	1.00	696	0.17	0.063	1.72	1.65	-0.010	-0.002	1.72	1.64	0.371	21.430	1.025	0.174	21.45	41.85
	7	0.081	1.00	695	0.091	0	1.56	1.56	-0.005	-0.000	1.56	1.56	0.000	-0.424	0.974	0.089	1.09	32.07

Avg. Duct Static = 1.92

	Average Temp.
Yaw Avg. =-0.93	695
Std. Dev. =8.82	

		Traverse Avg. Velocity in ft/s
Pitch Avg. =-2.80	Result Angle Avg. =13.01	32.04
Std. Dev. =12.21	Std. Dev. =7.85	

IP7_040106

Probes Point Velocity
32.26
30.98
30.21
32.25
31.52
31.88
31.52
31.16
30.97
30.79
30.03
30.61
31.18
31.20
31.20
31.02
31.77
31.40
31.22
30.85
30.85
30.86
31.97
30.47
30.08
29.50
31.04
31.23
30.86
30.86
30.48
31.05
30.67
31.60
30.29
31.04
30.08
30.09
30.09
31.58
30.08
30.66

	Probes
ı. Velocity in ft/s	
	30.94

IP7_040108

3D PROBE WORK SHEET

PROJECT:--- **Inter-Mountain** **OFA NE**
Date:.... **4/2/2003**
Load:...... **Damper 1/3 & 2/3**

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		691				
AVERAGE PRESSURE IN. W.C. (Pg)		1.31				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.10	25.10	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	37.68	37.89	
ACTUAL STACK VOLUME (Q acfm) =	145,058	145,884	0.57
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	55,814	56,132	0.57
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	55,814	56,132	0.57
FLOW IN LBS/HR (wet) =	251605	253038	0.57
FLOW IN LBS/HR (dry) =	251605	253038	0.57

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.028909
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

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Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In.W.C	P23-Patm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.122	0.00	691	0.037	0.028	1.29	1.36	0.256	0.006	1.28	1.37	0.757	54.163	0.583	0.022	54.16	9.25
	2	0.121	-3.00	691	0.021	-0.009	1.39	1.47	-0.001	-0.000	1.39	1.48	-0.095	-7.557	0.985	0.021	8.13	15.31
	3	0.126	-12.00	691	0.045	0	1.5	1.57	-0.005	-0.000	1.50	1.58	0.000	-0.424	0.974	0.044	12.01	22.02
	4	0.127	-3.00	691	0.084	0	1.34	1.36	-0.005	-0.000	1.34	1.36	0.000	-0.424	0.974	0.082	3.03	30.73
	5	0.127	3.00	691	0.158	0	1.43	1.37	-0.005	-0.001	1.43	1.36	0.000	-0.424	0.974	0.155	3.03	42.28
	6	0.122	7.00	691	0.184	-0.121	1.44	1.36	0.000	0.000	1.44	1.35	-0.658	-19.149	1.022	0.188	20.34	43.74
	7	0.125	25.00	691	0.192	-0.043	1.61	1.53	0.001	0.000	1.61	1.52	-0.224	-14.920	1.004	0.193	28.87	41.35
2	1	0.126	3.00	691	0.037	-0.004	1.58	1.66	-0.001	-0.000	1.58	1.67	-0.108	-8.377	0.986	0.036	8.89	20.29
	2	0.122	4.00	691	0.021	-0.006	1.34	1.43	0.000	0.000	1.34	1.45	-0.286	-18.519	1.019	0.021	18.93	14.88
	3	0.127	-2.00	691	0.041	-0.017	1.26	1.32	-0.003	-0.000	1.25	1.33	-0.415	-27.100	1.087	0.045	27.17	20.21
	4	0.126	4.00	691	0.073	-0.025	1.35	1.38	-0.001	-0.000	1.35	1.39	-0.342	-22.240	1.042	0.076	22.58	27.39
	5	0.123	8.00	691	0.126	-0.04	1.46	1.44	-0.000	-0.000	1.46	1.44	-0.317	-20.555	1.030	0.130	21.99	35.93
	6	0.12	15.00	691	0.154	-0.046	1.39	1.34	0.000	0.000	1.39	1.33	-0.299	-19.336	1.023	0.158	24.29	38.92
	7	0.123	28.00	691	0.231	-0.048	1.31	1.19	0.001	0.000	1.31	1.16	-0.208	-14.033	1.001	0.231	31.06	44.32
3	1	0.128	9.00	691	0.049	-0.006	1.12	1.18	-0.000	-0.000	1.12	1.19	-0.122	-9.257	0.988	0.048	12.88	23.08
	2	0.129	4.00	691	0.057	-0.005	1.15	1.2	-0.001	-0.000	1.15	1.21	-0.088	-7.063	0.984	0.056	8.11	25.22
	3	0.129	1.00	691	0.041	-0.007	1.06	1.13	0.000	0.000	1.06	1.14	-0.171	-12.015	0.995	0.041	12.06	21.25
	4	0.121	-1.00	691	0.066	0	1.2	1.24	-0.005	-0.000	1.20	1.25	0.000	-0.424	0.974	0.064	1.09	27.28
	5	0.121	9.00	691	0.133	-0.012	1.14	1.12	-0.001	-0.000	1.14	1.12	-0.090	-7.229	0.984	0.131	11.53	38.14
	6	0.126	10.00	691	0.161	-0.013	1.14	1.09	-0.001	-0.000	1.14	1.08	-0.081	-6.594	0.983	0.158	11.96	41.88
	7	0.124	25.00	691	0.232	-0.014	1.31	1.18	-0.002	-0.000	1.31	1.16	-0.060	-5.165	0.980	0.227	25.49	46.31
4	1	0.127	7.00	691	0.07	0.001	1.24	1.28	-0.005	-0.000	1.24	1.29	0.014	0.797	0.973	0.068	7.05	27.87
	2	0.122	2.00	691	0.065	0.003	1.27	1.3	-0.007	-0.000	1.27	1.31	0.046	3.612	0.973	0.063	4.13	26.98
	3	0.127	-5.00	691	0.052	-0.005	1.18	1.24	-0.001	-0.000	1.18	1.25	-0.096	-7.616	0.985	0.051	9.10	24.04
	4	0.124	-2.00	691	0.085	-0.002	1.2	1.22	-0.004	-0.000	1.20	1.22	-0.024	-2.360	0.976	0.083	3.09	30.95
	5	0.122	-3.00	691	0.122	0.002	1.23	1.21	-0.006	-0.001	1.23	1.21	0.016	0.980	0.973	0.119	3.16	37.02
	6	0.118	5.00	691	0.167	0.008	1.26	1.19	-0.007	-0.001	1.26	1.18	0.048	3.769	0.973	0.162	6.26	43.11
	7	0.126	13.00	691	0.227	0.002	1.39	1.26	-0.005	-0.001	1.39	1.24	0.009	0.326	0.974	0.221	13.00	49.28
5	1	0.13	0.00	691	0.242	-0.02	1.44	1.3	-0.001	-0.000	1.44	1.28	-0.083	-6.723	0.983	0.238	6.72	52.11
	2	0.122	-5.00	691	0.205	-0.02	1.42	1.31	-0.001	-0.000	1.42	1.29	-0.098	-7.707	0.985	0.202	9.18	47.72
	3	0.125	5.00	691	0.208	-0.005	1.3	1.2	-0.004	-0.001	1.30	1.18	-0.024	-2.400	0.976	0.203	5.55	48.26
	4	0.122	-4.00	691	0.204	0.01	1.4	1.3	-0.007	-0.001	1.40	1.28	0.049	3.869	0.973	0.198	5.56	47.70
	5	0.122	0.00	691	0.202	0.025	1.28	1.18	-0.010	-0.002	1.28	1.16	0.124	10.488	0.980	0.198	10.49	47.07
	6	0.122	0.00	691	0.171	0.026	1.33	1.26	-0.011	-0.002	1.33	1.25	0.152	12.774	0.985	0.169	12.77	43.07
	7	0.119	4.00	691	0.145	0.029	1.27	1.23	-0.011	-0.002	1.27	1.22	0.200	16.082	0.997	0.145	16.56	39.20
6	1	0.121	-3.00	691	0.375	-0.026	1.65	1.36	-0.002	-0.001	1.65	1.31	-0.069	-5.806	0.981	0.368	6.53	64.83
	2	0.123	2.00	691	0.367	-0.006	1.64	1.37	-0.004	-0.001	1.64	1.32	-0.016	-1.780	0.976	0.358	2.68	64.30
	3	0.131	5.00	691	0.339	0.022	1.64	1.4	-0.008	-0.003	1.64	1.36	0.065	5.299	0.973	0.330	7.28	61.29
	4	0.127	0.00	691	0.35	0.043	1.58	1.33	-0.010	-0.003	1.58	1.29	0.123	10.412	0.980	0.343	10.41	61.96
	5	0.125	0.00	691	0.303	0.057	1.7	1.5	-0.011	-0.003	1.70	1.46	0.188	15.340	0.994	0.301	15.34	56.91
	6	0.121	5.00	691	0.253	0.064	1.57	1.42	-0.010	-0.003	1.57	1.39	0.253	18.687	1.009	0.255	19.32	51.27
	7	0.121	4.00	691	0.128	0.076	1.45	1.44	0.070	0.011	1.44	1.44	0.594	49.137	1.218	0.156	49.26	27.72

Avg. Duct Static = 1.31

	Average Temp.
Yaw Avg. =3.81	
Std. Dev. =8.12	691

		Traverse
Pitch Avg. =-1.18	Result Angle Avg. =14.07	Avg. Velocity in ft/s
Std. Dev. =15.99	Std. Dev. =11.56	37.68

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Probes Point Velocity
37.57
37.41
38.17
38.33
38.33
37.57
38.02
38.16
37.57
38.33
38.18
37.72
37.26
37.74
38.49
38.64
38.65
37.42
37.43
38.20
37.89
38.34
37.57
38.34
37.88
37.58
36.96
38.19
38.79
37.57
38.04
37.57
37.58
37.58
37.11
37.42
37.73
38.93
38.34
38.02
37.41
37.41

	Probes
;. Velocity in ft/s	
	37.89

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<date>

3D PROBE WORK SHEET

PROJECT:--- **Inter-Mountain** **OFA NW**
Date:.... **4/2/2003**
Load:...... **Damper 1/3**

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		687				
AVERAGE PRESSURE IN. W.C. (Pg)		2.17				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.16	25.16	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	29.06	28.56	
ACTUAL STACK VOLUME (Q acfm) =	111,897	109,943	-1.75
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	43,314	42,558	-1.75
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	43,314	42,558	-1.75
FLOW IN LBS/HR (wet) =	195256	191848	-1.75
FLOW IN LBS/HR (dry) =	195256	191848	-1.75

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.029083
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In. W.C.	P23-Patm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.076	0.00	687	0.004	0	1.89	1.99	-0.005	-0.000	1.89	2.01	0.000	-0.424	0.974	0.004	0.42	6.70
	2	0.074	5.00	687	0.007	-0.005	2.03	2.13	0.001	0.000	2.03	2.15	-0.714	-13.225	0.999	0.007	14.12	8.70
	3	0.074	5.00	687	0.031	-0.024	2.03	2.1	0.000	0.000	2.03	2.11	-0.774	-19.973	1.027	0.032	20.56	17.92
	4	0.071	3.00	687	0.05	-0.034	1.95	2	0.001	0.000	1.95	2.01	-0.680	-16.274	1.009	0.050	16.54	23.10
	5	0.073	0.00	687	0.069	-0.044	1.95	1.98	-0.001	-0.000	1.95	1.99	-0.638	-21.803	1.039	0.072	21.80	26.66
	6	0.067	0.00	687	0.084	-0.039	2.06	2.08	-0.005	-0.000	2.06	2.08	-0.464	-29.693	1.120	0.094	29.69	28.58
	7	0.065	-11.00	687	0.081	-0.015	2.11	2.13	0.001	0.000	2.11	2.13	-0.185	-12.805	0.997	0.081	16.82	29.18
2	1	0.071	0.00	687	0.007	-0.004	1.95	2.06	-0.004	-0.000	1.95	2.07	-0.571	-28.682	1.107	0.008	28.68	8.28
	2	0.066	2.00	687	0.017	-0.007	2.06	2.16	-0.003	-0.000	2.06	2.17	-0.412	-26.921	1.085	0.018	26.99	12.98
	3	0.069	5.00	687	0.024	-0.015	2.06	2.16	-0.001	-0.000	2.06	2.17	-0.625	-23.419	1.051	0.025	23.92	15.57
	4	0.071	3.00	687	0.056	-0.016	2.05	2.1	0.000	0.000	2.05	2.11	-0.286	-18.519	1.019	0.057	18.75	24.26
	5	0.075	2.00	687	0.095	-0.028	2.1	2.11	0.000	0.000	2.10	2.11	-0.295	-19.084	1.022	0.097	19.18	31.56
	6	0.068	0.00	687	0.093	-0.028	2.03	2.04	0.000	0.000	2.03	2.04	-0.301	-19.488	1.024	0.095	19.49	31.21
	7	0.068	-15.00	687	0.112	-0.018	2.05	2.04	0.000	0.000	2.05	2.04	-0.161	-11.462	0.994	0.111	18.80	33.88
3	1	0.071	6.00	687	0.032	-0.006	2.11	2.18	0.001	0.000	2.11	2.19	-0.188	-12.930	0.998	0.032	14.23	18.58
	2	0.076	8.00	687	0.027	-0.004	2.05	2.13	0.000	0.000	2.05	2.14	-0.148	-10.756	0.992	0.027	13.38	17.08
	3	0.07	11.00	687	0.035	-0.003	2.14	2.21	-0.001	-0.000	2.14	2.22	-0.086	-6.929	0.983	0.034	12.98	19.39
	4	0.072	10.00	687	0.072	-0.013	2.14	2.17	0.001	0.000	2.14	2.18	-0.181	-12.553	0.997	0.072	16.00	27.62
	5	0.067	10.00	687	0.092	-0.009	2.2	2.22	-0.001	-0.000	2.20	2.22	-0.098	-7.725	0.985	0.091	12.61	31.50
	6	0.066	0.00	687	0.105	-0.006	2.35	2.35	-0.002	-0.000	2.35	2.35	-0.057	-4.933	0.980	0.103	4.93	34.27
	7	0.073	-11.00	687	0.14	-0.006	2.3	2.26	-0.003	-0.000	2.30	2.25	-0.043	-3.868	0.978	0.137	11.65	38.87
4	1	0.072	9.00	687	0.066	-0.001	2.23	2.27	-0.004	-0.000	2.23	2.28	-0.015	-1.682	0.976	0.064	9.15	26.86
	2	0.068	3.00	687	0.061	-0.006	2.2	2.24	-0.001	-0.000	2.20	2.25	-0.098	-7.759	0.985	0.060	8.32	26.01
	3	0.071	12.00	687	0.06	0.002	2.14	2.18	-0.007	-0.000	2.14	2.19	0.033	2.468	0.973	0.058	12.25	25.32
	4	0.074	14.00	687	0.083	0.001	2.2	2.22	-0.005	-0.000	2.20	2.22	0.012	0.604	0.974	0.081	14.01	29.58
	5	0.064	15.00	687	0.082	0.002	2.07	2.09	-0.006	-0.000	2.07	2.09	0.024	1.678	0.973	0.080	15.09	29.25
	6	0.072	9.00	687	0.109	0.003	2.28	2.28	-0.006	-0.001	2.28	2.28	0.028	1.954	0.973	0.106	9.21	34.47
	7	0.073	-3.00	687	0.125	0.006	2.35	2.33	-0.007	-0.001	2.35	2.33	0.048	3.778	0.973	0.122	4.82	37.26
5	1	0.07	5.00	687	0.141	0	2.35	2.32	-0.005	-0.001	2.35	2.31	0.000	-0.424	0.974	0.137	5.02	39.59
	2	0.07	9.00	687	0.115	0.004	2.15	2.14	-0.007	-0.001	2.15	2.14	0.035	2.597	0.973	0.112	9.36	35.40
	3	0.07	11.00	687	0.113	0.011	2.26	2.25	-0.009	-0.001	2.26	2.25	0.097	8.205	0.976	0.110	13.69	34.60
	4	0.074	10.00	687	0.136	0.016	2.38	2.35	-0.010	-0.001	2.38	2.34	0.118	9.970	0.979	0.133	14.08	37.95
	5	0.074	5.00	687	0.135	0.024	2.28	2.25	-0.011	-0.001	2.28	2.24	0.178	14.651	0.991	0.134	15.46	37.81
	6	0.073	5.00	687	0.114	0.024	2.17	2.16	-0.011	-0.001	2.17	2.16	0.211	16.692	0.999	0.114	17.40	34.54
	7	0.07	8.00	687	0.061	0.021	2.04	2.08	-0.010	-0.001	2.04	2.09	0.344	20.933	1.022	0.062	22.35	24.77
6	1	0.071	5.00	687	0.223	0.008	2.31	2.19	-0.007	-0.001	2.31	2.17	0.036	2.694	0.973	0.217	5.68	49.71
	2	0.071	10.00	687	0.201	0.018	2.27	2.17	-0.009	-0.002	2.27	2.15	0.090	7.513	0.975	0.196	12.49	46.36
	3	0.07	10.00	687	0.187	0.03	2.28	2.2	-0.011	-0.002	2.28	2.19	0.160	13.409	0.987	0.185	16.67	44.14
	4	0.077	15.00	687	0.19	0.043	2.37	2.28	-0.010	-0.002	2.37	2.26	0.226	17.522	1.003	0.191	22.91	43.12
	5	0.068	8.00	687	0.165	0.048	2.28	2.21	-0.010	-0.002	2.28	2.20	0.291	19.876	1.015	0.168	21.37	40.88
	6	0.072	10.00	687	0.13	0.054	2.22	2.19	-0.010	-0.001	2.22	2.18	0.415	22.792	1.035	0.135	24.78	35.72
	7	0.073	12.00	687	0.043	0	2.1	2.17	-0.005	-0.000	2.10	2.18	0.000	-0.424	0.974	0.042	12.01	21.47

Avg. Duct Static = 2.17

Yaw Avg. =4.88	Average Temp.
Std. Dev. =6.87	687

Pitch Avg. =-3.91	Result Angle Avg. =15.42	Traverse Avg. Velocity in ft/s
Std. Dev. =14.21	Std. Dev. =6.68	29.06

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Probes Point Velocity
29.57
29.18
29.18
28.58
28.99
27.76
27.35
28.58
27.34
28.17
28.58
29.37
27.97
27.97
28.58
29.57
28.37
28.78
27.76
27.55
28.97
28.77
27.96
28.58
29.17
27.14
28.77
28.97
28.37
28.38
28.37
29.17
29.17
28.98
28.38
28.58
28.58
28.38
29.76
27.97
28.78
28.98

	Probes
). Velocity in ft/s	
	28.56

IP7_040116

3D PROBE WORK SHEET

PROJECT:--- **Inter-Mountain** **OFA NW**
Date:.... **4/2/2003**
Load:...... **Damper 2/3**

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		695				
AVERAGE PRESSURE IN. W.C. (Pg)		1.75				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.13	25.13	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	39.50	40.10	
ACTUAL STACK VOLUME (Q acfm) =	152,070	154,387	1.52
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	58,385	59,274	1.52
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	58,385	59,274	1.52
FLOW IN LBS/HR (wet) =	263194	267202	1.52
FLOW IN LBS/HR (dry) =	263194	267202	1.52

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.028846
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

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Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In. W.C.	P23-Patm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.132	17.00	695	0.019	0	1.41	1.49	-0.005	-0.000	1.41	1.50	0.000	-0.424	0.974	0.019	17.01	14.02
	2	0.129	0.00	695	0.025	0.007	1.48	1.55	-0.010	-0.000	1.48	1.56	0.280	19.585	1.014	0.025	19.59	16.15
	3	0.138	4.00	695	0.043	-0.03	1.53	1.59	0.001	0.000	1.53	1.60	-0.698	-14.387	1.002	0.043	14.92	21.61
	4	0.134	5.00	695	0.084	-0.044	1.64	1.66	-0.005	-0.001	1.64	1.66	-0.524	-30.602	1.132	0.095	30.97	28.48
	5	0.137	5.00	695	0.118	-0.059	1.67	1.66	-0.005	-0.001	1.67	1.66	-0.500	-30.619	1.133	0.134	30.99	33.75
	6	0.133	0.00	695	0.166	-0.061	1.72	1.65	-0.002	-0.000	1.72	1.64	-0.367	-23.961	1.055	0.175	23.96	41.20
	7	0.137	-7.00	695	0.154	-0.022	1.65	1.59	0.000	0.000	1.65	1.58	-0.143	-10.454	0.991	0.153	12.56	41.08
2	1	0.136	7.00	695	0.031	0.013	1.58	1.65	-0.009	-0.000	1.58	1.66	0.419	22.968	1.037	0.032	23.96	17.64
	2	0.141	6.00	696	0.029	-0.009	1.59	1.66	-0.000	-0.000	1.59	1.67	-0.310	-20.088	1.028	0.030	20.68	17.39
	3	0.138	7.00	696	0.05	-0.02	1.69	1.74	-0.003	-0.000	1.69	1.75	-0.400	-26.164	1.077	0.054	27.02	22.26
	4	0.136	2.00	695	0.1	-0.018	1.81	1.81	0.001	0.000	1.81	1.81	-0.180	-12.522	0.997	0.100	12.68	33.16
	5	0.145	-1.00	695	0.13	-0.028	1.69	1.66	0.001	0.000	1.69	1.65	-0.215	-14.448	1.003	0.130	14.48	37.65
	6	0.135	4.00	695	0.193	-0.037	1.78	1.68	0.001	0.000	1.78	1.66	-0.192	-13.159	0.998	0.193	13.74	45.93
	7	0.14	-7.00	695	0.218	-0.027	1.93	1.81	-0.000	-0.000	1.93	1.79	-0.124	-9.341	0.988	0.215	11.65	48.96
3	1	0.144	2.00	695	0.074	-0.009	1.41	1.43	-0.000	-0.000	1.41	1.43	-0.122	-9.207	0.988	0.073	9.42	28.74
	2	0.137	8.00	695	0.056	-0.009	1.42	1.46	0.000	0.000	1.42	1.47	-0.161	-11.462	0.994	0.056	13.95	24.66
	3	0.141	6.00	695	0.066	-0.013	1.3	1.34	0.001	0.000	1.30	1.35	-0.197	-13.445	0.999	0.066	14.70	26.77
	4	0.134	-2.00	695	0.126	-0.026	1.45	1.43	0.001	0.000	1.45	1.43	-0.206	-13.955	1.001	0.126	14.09	37.11
	5	0.142	2.00	695	0.176	-0.021	1.65	1.57	-0.000	-0.000	1.65	1.56	-0.119	-9.068	0.988	0.174	9.28	44.33
	6	0.139	-1.00	695	0.206	-0.014	1.7	1.6	-0.002	-0.000	1.70	1.58	-0.068	-5.709	0.981	0.202	5.80	48.18
	7	0.144	-11.00	695	0.265	-0.013	1.67	1.5	-0.002	-0.001	1.67	1.47	-0.049	-4.336	0.979	0.259	11.81	53.71
4	1	0.132	7.00	695	0.128	-0.008	2.13	2.11	-0.002	-0.000	2.13	2.11	-0.063	-5.320	0.981	0.126	8.78	37.68
	2	0.139	6.00	695	0.119	-0.008	1.93	1.92	-0.002	-0.000	1.93	1.92	-0.067	-5.657	0.981	0.117	8.24	36.41
	3	0.142	9.00	695	0.12	-0.004	1.94	1.92	-0.003	-0.000	1.94	1.92	-0.033	-3.135	0.977	0.117	9.53	36.36
	4	0.141	13.00	695	0.153	0.004	1.94	1.89	-0.006	-0.001	1.94	1.88	0.026	1.833	0.973	0.149	13.13	40.46
	5	0.137	15.00	695	0.179	0.002	1.95	1.87	-0.005	-0.001	1.95	1.86	0.011	0.529	0.974	0.174	15.01	43.42
	6	0.14	19.00	695	0.216	0.009	1.97	1.85	-0.007	-0.001	1.97	1.83	0.042	3.210	0.973	0.210	19.26	46.60
	7	0.146	0.00	695	0.257	0.009	1.98	1.82	-0.007	-0.002	1.98	1.79	0.035	2.618	0.973	0.250	2.62	53.79
5	1	0.148	8.00	695	0.232	-0.01	1.62	1.5	-0.003	-0.001	1.62	1.48	-0.043	-3.887	0.978	0.227	8.89	50.71
	2	0.142	9.00	695	0.219	-0.004	1.6	1.48	-0.004	-0.001	1.60	1.46	-0.018	-1.936	0.976	0.214	9.20	49.16
	3	0.138	11.00	695	0.227	0.004	1.63	1.5	-0.006	-0.001	1.63	1.48	0.018	1.087	0.973	0.221	11.05	49.70
	4	0.14	8.00	695	0.249	0.016	1.64	1.49	-0.008	-0.002	1.64	1.46	0.064	5.241	0.973	0.242	9.55	52.30
	5	0.135	4.00	695	0.228	0.025	1.71	1.58	-0.010	-0.002	1.71	1.56	0.110	9.282	0.978	0.223	10.10	50.07
	6	0.138	6.00	695	0.199	0.037	1.72	1.62	-0.011	-0.002	1.72	1.60	0.186	15.198	0.993	0.198	16.31	45.96
	7	0.145	10.00	695	0.114	0.043	1.75	1.74	-0.010	-0.001	1.75	1.74	0.377	21.577	1.026	0.117	23.68	33.73
6	1	0.139	9.00	695	0.327	0	2.85	2.62	-0.005	-0.002	2.85	2.58	0.000	-0.424	0.974	0.319	9.01	59.96
	2	0.131	10.00	695	0.319	0.012	2.7	2.47	-0.007	-0.002	2.70	2.43	0.038	2.849	0.973	0.310	10.39	58.95
	3	0.141	12.00	695	0.305	0.034	2.53	2.32	-0.010	-0.003	2.53	2.28	0.111	9.440	0.978	0.298	15.23	56.71
	4	0.137	12.00	695	0.281	0.056	2.42	2.24	-0.011	-0.003	2.42	2.21	0.199	16.039	0.996	0.280	19.94	53.53
	5	0.138	9.00	695	0.262	0.07	2.33	2.16	-0.010	-0.003	2.33	2.13	0.267	19.193	1.011	0.265	21.13	51.68
	6	0.145	13.00	696	0.204	0.083	2.2	2.09	-0.010	-0.002	2.20	2.07	0.407	22.451	1.033	0.211	25.77	44.49
	7	0.139	15.00	695	0.057	0	2.06	2.11	-0.005	-0.000	2.06	2.12	0.000	-0.424	0.974	0.056	15.01	24.50

Avg. Duct Static = 1.75

	Average Temp.
Yaw Avg. =5.95	
Std. Dev. =6.42	695

		Traverse
Pitch Avg. =-2.88	Result Angle Avg. =15.12	Avg. Velocity in ft/s
Std. Dev. =13.89	Std. Dev. =6.62	39.50

IP7_040118

Probes Point Velocity
39.14
38.69
40.01
39.43
39.87
39.28
39.87
39.72
40.44
40.01
39.71
41.01
39.57
40.29
40.88
39.88
40.46
39.44
40.59
40.16
40.88
39.11
40.14
40.57
40.43
39.85
40.29
41.15
41.45
40.60
40.02
40.31
39.58
40.01
41.01
40.10
38.94
40.41
39.83
39.98
40.99
40.13

	Probes
ı. Velocity in ft/s	
	40.10

<date>

3D PROBE WORK SHEET

PROJECT:--- **Inter-Mountain** **OFA NW**
Date:.... **4/2/2003**
Load:...... **Damper 1/3 & 2/3**

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		698				
AVERAGE PRESSURE IN. W.C. (Pg)		1.14				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.08	25.08	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	43.22	44.01	
ACTUAL STACK VOLUME (Q acfm) =	166,393	169,421	1.82
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	63,605	64,762	1.82
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	63,605	64,762	1.82
FLOW IN LBS/HR (wet) =	286726	291941	1.82
FLOW IN LBS/HR (dry) =	286726	291941	1.82

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.028720
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

IP7_040121

Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In. W.C.	P23-Patm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.174	5.00	698	0.049	0.023	1.08	1.14	-0.009	-0.000	1.08	1.15	0.469	26.425	1.070	0.052	26.86	22.04
	2	0.174	8.00	698	0.055	0.009	1.13	1.18	-0.011	-0.001	1.13	1.19	0.164	13.646	0.988	0.054	15.78	24.21
	3	0.17	5.00	698	0.046	-0.031	1.09	1.13	0.001	0.000	1.06	1.14	-0.674	-17.021	1.012	0.047	17.72	22.18
	4	0.171	5.00	698	0.071	-0.053	1.09	1.1	0.001	0.000	1.06	1.11	-0.746	-13.987	1.001	0.071	14.84	27.81
	5	0.171	25.00	698	0.124	-0.059	1.18	1.16	-0.005	-0.001	1.18	1.16	-0.476	-30.100	1.125	0.140	38.36	31.61
	6	0.169	0.00	698	0.161	-0.078	1.18	1.12	-0.005	-0.001	1.18	1.11	-0.484	-30.341	1.129	0.182	30.34	39.71
	7	0.173	-7.00	698	0.168	-0.027	1.19	1.12	0.000	0.000	1.19	1.11	-0.161	-11.462	0.994	0.167	13.41	42.90
2	1	0.163	2.00	698	0.064	0.006	0.95	1	-0.009	-0.001	0.95	1.01	0.094	7.887	0.976	0.062	8.13	26.70
	2	0.166	12.00	698	0.032	-0.007	0.94	1.02	0.001	0.000	0.94	1.03	-0.219	-14.633	1.003	0.032	18.84	18.30
	3	0.168	5.00	698	0.049	-0.015	1	1.05	0.000	0.000	1.00	1.07	-0.306	-19.813	1.026	0.050	20.41	22.68
	4	0.166	1.00	698	0.11	-0.025	1.09	1.09	0.001	0.000	1.09	1.09	-0.227	-15.103	1.005	0.111	15.14	34.64
	5	0.168	1.00	698	0.164	-0.033	1.09	1.04	0.001	0.000	1.09	1.03	-0.201	-13.675	1.000	0.164	13.71	42.47
	6	0.161	-3.00	698	0.229	-0.048	1.25	1.12	0.001	0.000	1.25	1.10	-0.210	-14.132	1.001	0.229	14.44	50.06
	7	0.161	-10.00	698	0.237	-0.031	1.28	1.16	-0.000	-0.000	1.28	1.13	-0.131	-9.754	0.989	0.234	13.93	50.73
3	1	0.16	1.00	698	0.107	-0.009	1.19	1.2	-0.001	-0.000	1.19	1.20	-0.084	-6.822	0.983	0.105	6.89	34.75
	2	0.165	1.00	698	0.071	-0.011	1.18	1.21	0.000	0.000	1.18	1.22	-0.155	-11.139	0.993	0.070	11.18	28.11
	3	0.172	6.00	698	0.07	-0.013	1.26	1.29	0.001	0.000	1.26	1.30	-0.186	-12.833	0.997	0.070	14.15	27.65
	4	0.17	7.00	698	0.161	-0.019	1.28	1.23	-0.000	-0.000	1.28	1.22	-0.118	-8.988	0.988	0.159	11.37	42.19
	5	0.164	2.00	698	0.219	-0.017	1.19	1.07	-0.001	-0.000	1.19	1.05	-0.078	-6.382	0.982	0.215	6.69	49.73
	6	0.174	-2.00	698	0.243	-0.016	1.46	1.32	-0.002	-0.000	1.46	1.30	-0.066	-5.559	0.981	0.238	5.91	52.40
	7	0.173	-12.00	698	0.3	-0.01	1.45	1.26	-0.003	-0.001	1.45	1.23	-0.033	-3.135	0.977	0.293	12.40	57.07
4	1	0.172	8.00	698	0.181	-0.01	1.2	1.12	-0.002	-0.000	1.20	1.11	-0.055	-4.794	0.980	0.177	9.32	44.85
	2	0.169	9.00	698	0.141	-0.012	1.13	1.09	-0.001	-0.000	1.13	1.08	-0.085	-6.889	0.983	0.139	11.32	39.41
	3	0.165	12.00	698	0.168	0	1.19	1.12	-0.005	-0.001	1.19	1.11	0.000	-0.424	0.974	0.164	12.01	42.71
	4	0.162	10.00	698	0.167	-0.002	1.11	1.05	-0.004	-0.001	1.11	1.04	-0.012	-1.422	0.975	0.163	10.10	42.89
	5	0.167	13.00	698	0.214	-0.006	1.04	0.93	-0.003	-0.001	1.04	0.91	-0.028	-2.718	0.977	0.209	13.28	48.04
	6	0.162	1.00	698	0.251	0.009	1.24	1.09	-0.007	-0.002	1.24	1.06	0.036	2.692	0.973	0.244	2.87	53.27
	7	0.159	-3.00	698	0.275	0.017	1.28	1.1	-0.008	-0.002	1.28	1.07	0.062	5.022	0.973	0.268	5.85	55.55
5	1	0.161	10.00	698	0.271	-0.015	1.19	1.02	-0.002	-0.001	1.19	0.99	-0.055	-4.802	0.980	0.265	11.08	54.58
	2	0.16	11.00	698	0.248	-0.006	1.24	1.09	-0.004	-0.001	1.24	1.06	-0.024	-2.413	0.976	0.242	11.26	52.09
	3	0.164	13.00	698	0.276	0.004	1.38	1.21	-0.006	-0.001	1.38	1.18	0.014	0.815	0.973	0.269	13.03	54.50
	4	0.155	10.00	698	0.274	0.022	1.46	1.28	-0.009	-0.002	1.46	1.25	0.080	6.685	0.974	0.267	12.01	54.54
	5	0.169	5.00	698	0.279	0.038	1.32	1.14	-0.010	-0.003	1.32	1.11	0.136	11.518	0.982	0.274	12.54	55.15
	6	0.157	0.00	698	0.239	0.044	1.34	1.2	-0.011	-0.003	1.34	1.18	0.184	15.077	0.993	0.237	15.08	50.76
	7	0.171	12.00	698	0.149	0.046	1.18	1.14	-0.010	-0.002	1.18	1.13	0.309	20.281	1.018	0.152	23.44	38.56
6	1	0.163	13.00	698	0.395	0.004	1.6	1.31	-0.005	-0.002	1.60	1.26	0.010	0.439	0.974	0.385	13.01	65.20
	2	0.171	9.00	698	0.348	0.012	1.36	1.11	-0.007	-0.002	1.36	1.07	0.034	2.570	0.973	0.339	9.36	61.97
	3	0.165	12.00	698	0.355	0.041	1.45	1.19	-0.010	-0.003	1.45	1.14	0.115	9.786	0.979	0.347	15.44	61.32
	4	0.167	14.00	698	0.35	0.073	1.63	1.38	-0.011	-0.004	1.63	1.34	0.209	16.582	0.999	0.350	21.57	59.32
	5	0.162	15.00	698	0.317	0.075	1.65	1.43	-0.010	-0.003	1.65	1.39	0.237	18.006	1.005	0.319	23.27	55.94
	6	0.163	14.00	698	0.265	0.092	1.45	1.28	-0.010	-0.003	1.45	1.25	0.347	20.984	1.022	0.271	25.05	50.88
	7	0.168	18.00	698	0.07	0.02	1.17	1.21	-0.010	-0.001	1.17	1.22	0.286	19.742	1.014	0.071	26.47	25.74

Avg. Duct Static = 1.14

	Average Temp.
Yaw Avg. =6.14	
Std. Dev. =7.51	698

		Traverse Avg. Velocity in ft/s
Pitch Avg. =-1.67	Result Angle Avg. = 14.95	
Std. Dev. = 13.59	Std. Dev. = 7.14	43.22

IP7_040122

IP7_040123

Probes Point Velocity
45.02
45.02
44.50
44.63
44.63
44.37
44.89
43.58
43.98
44.24
43.84
44.24
43.31
43.31
43.17
43.83
44.75
44.49
43.71
45.01
44.88
44.76
44.37
43.84
43.45
44.12
43.44
43.04
43.31
43.18
43.70
42.48
44.37
42.76
44.63
43.57
44.63
43.84
44.09
43.42
43.57
44.23

	Probes
ı. Velocity in ft/s	
	44.01

<date>

3D PROBE WORK SHEET

PROJECT:--- **Inter-Mountain** **OFA SE**
Date:.... **4/2/2003**
Load:...... **Damper 1/3**

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		685				
AVERAGE PRESSURE IN. W.C. (Pg)		1.98				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.15	25.15	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	23.08	18.80	
ACTUAL STACK VOLUME (Q acfm) =	88,862	72,363	-18.57
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	34,438	28,044	-18.57
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	34,438	28,044	-18.57
FLOW IN LBS/HR (wet) =	155244	126420	-18.57
FLOW IN LBS/HR (dry) =	155244	126420	-18.57

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.029117
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

<date>

Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In. W.C.	P23-Patm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.031	1.00	685	0.018	0	1.9	1.98	-0.005	-0.000	1.90	1.99	0.000	-0.424	0.974	0.018	1.09	14.19
	2	0.031	5.00	685	0.025	0	2	2.08	-0.005	-0.000	2.00	2.09	0.000	-0.424	0.974	0.024	5.02	16.66
	3	0.031	7.00	685	0.032	-0.02	2.1	2.17	-0.001	-0.000	2.10	2.18	-0.625	-23.419	1.051	0.034	24.39	17.90
	4	0.033	3.00	685	0.047	0	1.87	1.93	-0.005	-0.000	1.87	1.94	0.000	-0.424	0.974	0.046	3.03	22.91
	5	0.032	5.00	685	0.053	0	1.94	1.89	-0.005	-0.000	1.94	2.00	0.000	-0.424	0.974	0.052	5.02	24.26
	6	0.03	8.00	686	0.065	-0.041	1.91	1.96	-0.001	-0.000	1.91	1.96	-0.631	-22.695	1.045	0.068	23.99	25.52
	7	0.031	12.00	685	0.074	-0.018	2.06	2.09	0.001	0.000	2.06	2.10	-0.243	-16.000	1.008	0.075	19.91	27.52
2	1	0.031	-5.00	686	0.021	-0.01	1.86	1.94	-0.005	-0.000	1.86	1.95	-0.476	-30.112	1.126	0.024	30.49	14.20
	2	0.032	6.00	686	0.026	-0.015	1.74	1.82	-0.004	-0.000	1.74	1.83	-0.577	-28.287	1.102	0.029	28.86	15.89
	3	0.031	5.00	686	0.026	-0.014	1.97	2.04	-0.005	-0.000	1.97	2.05	-0.538	-30.293	1.128	0.029	30.66	15.79
	4	0.031	0.00	686	0.041	-0.015	2.06	2.12	-0.002	-0.000	2.05	2.13	-0.366	-23.850	1.055	0.043	23.85	20.38
	5	0.031	5.00	685	0.05	-0.018	1.94	1.99	-0.001	-0.000	1.94	2.00	-0.360	-23.446	1.051	0.053	23.94	22.46
	6	0.032	12.00	685	0.07	-0.019	1.92	1.95	0.001	0.000	1.92	1.96	-0.271	-17.646	1.015	0.071	21.23	26.63
	7	0.031	30.00	685	0.086	-0.011	1.83	1.84	-0.000	-0.000	1.83	1.84	-0.128	-9.583	0.989	0.085	31.36	26.70
3	1	0.03	8.00	685	0.02	-0.001	1.76	1.84	-0.002	-0.000	1.76	1.85	-0.050	-4.406	0.979	0.020	9.13	14.81
	2	0.028	3.00	685	0.019	0	1.82	1.91	-0.005	-0.000	1.82	1.93	0.000	-0.424	0.974	0.019	3.03	14.56
	3	0.032	4.00	685	0.013	0.001	1.82	1.9	-0.009	-0.000	1.82	1.91	0.077	6.382	0.974	0.013	7.53	11.96
	4	0.031	6.00	685	0.032	0	1.89	1.96	-0.005	-0.000	1.89	1.97	0.000	-0.424	0.974	0.031	6.01	18.82
	5	0.03	10.00	685	0.04	0	1.94	2	-0.005	-0.000	1.94	2.01	0.000	-0.424	0.974	0.039	10.01	20.84
	6	0.029	13.00	686	0.064	0.001	1.98	2.02	-0.006	-0.000	1.98	2.03	0.016	0.913	0.973	0.062	13.03	26.06
	7	0.029	37.00	685	0.082	0.001	2.03	2.05	-0.005	-0.000	2.03	2.05	0.012	0.617	0.974	0.080	37.00	24.18
4	1	0.031	0.00	685	0.036	0.006	1.84	1.9	-0.011	-0.000	1.84	1.91	0.167	13.867	0.989	0.036	13.87	19.63
	2	0.033	7.00	685	0.036	0.006	1.78	1.85	-0.011	-0.000	1.78	1.86	0.167	13.867	0.989	0.036	15.50	19.49
	3	0.029	4.00	685	0.034	0.012	1.98	2.05	-0.010	-0.000	1.98	2.06	0.353	21.087	1.023	0.035	21.45	18.60
	4	0.033	5.00	685	0.037	0.01	1.78	1.85	-0.010	-0.000	1.78	1.86	0.270	19.293	1.012	0.037	19.91	19.50
	5	0.029	12.00	685	0.042	0.009	1.75	1.81	-0.010	-0.000	1.75	1.82	0.214	16.899	1.000	0.042	20.62	20.56
	6	0.029	12.00	685	0.05	0.007	1.75	1.8	-0.010	-0.001	1.75	1.81	0.140	11.825	0.983	0.049	16.79	22.76
	7	0.029	25.00	685	0.073	0.006	1.88	1.91	-0.009	-0.001	1.88	1.92	0.082	6.855	0.975	0.071	25.86	25.73
5	1	0.03	1.00	685	0.071	0.025	1.81	1.84	-0.010	-0.001	1.81	1.85	0.352	21.072	1.023	0.073	21.09	26.95
	2	0.029	7.00	685	0.065	0.021	1.85	1.89	-0.010	-0.001	1.85	1.90	0.323	20.559	1.019	0.066	21.67	25.65
	3	0.032	7.00	685	0.068	0.03	1.97	2	-0.009	-0.001	1.97	2.01	0.441	24.167	1.047	0.071	25.10	25.90
	4	0.032	11.00	685	0.068	0.028	1.97	2.01	-0.010	-0.001	1.97	2.02	0.412	22.641	1.034	0.070	25.04	25.75
	5	0.033	10.00	685	0.076	0.026	2.07	2.1	-0.010	-0.001	2.07	2.11	0.342	20.896	1.022	0.078	23.07	27.47
	6	0.03	15.00	685	0.066	0.02	1.91	1.95	-0.010	-0.001	1.91	1.96	0.303	20.160	1.017	0.067	24.94	25.18
	7	0.03	22.00	685	0.083	0.013	1.9	1.93	-0.011	-0.001	1.90	1.94	0.157	13.123	0.986	0.082	25.45	27.70
6	1	0.03	2.00	685	0.091	0.023	2.04	2.06	-0.010	-0.001	2.04	2.06	0.253	18.679	1.009	0.092	18.78	30.74
	2	0.031	5.00	685	0.114	0.036	1.96	1.95	-0.010	-0.001	1.96	1.95	0.316	20.422	1.019	0.116	21.00	34.10
	3	0.031	1.00	685	0.105	0.047	1.87	1.87	-0.009	-0.001	1.87	1.87	0.448	24.606	1.051	0.110	24.62	32.37
	4	0.029	6.00	685	0.1	0.048	1.98	1.98	-0.009	-0.001	1.98	1.98	0.480	27.521	1.082	0.108	28.12	31.10
	5	0.032	6.00	685	0.089	0.042	2.08	2.1	-0.009	-0.001	2.08	2.10	0.472	26.672	1.072	0.095	27.29	29.42
	6	0.032	8.00	685	0.079	0.03	2.11	2.13	-0.010	-0.001	2.11	2.13	0.380	21.637	1.027	0.081	23.00	28.09
	7	0.031	7.00	685	0.085	0.006	2.09	2.1	-0.008	-0.001	2.09	2.10	0.071	5.812	0.974	0.083	9.09	30.44

Avg. Duct Static = 1.98

	Average Temp.
Yaw Avg. =8.19	685
Std. Dev. =8.06	

		Traverse Avg. Velocity in ft/s
Pitch Avg. =3.97	Result Angle Avg. =19.31	23.08
Std. Dev. =17.71	Std. Dev. =8.92	

IP7_040126

Probes Point Velocity
18.87
18.87
18.87
19.47
19.17
18.57
18.87
18.87
19.18
18.87
18.87
18.87
19.17
18.88
18.57
17.94
19.18
18.87
18.56
18.25
18.25
18.87
19.47
18.25
19.47
18.26
18.26
18.25
18.57
18.26
19.17
19.17
19.47
18.57
18.57
18.56
18.87
18.88
18.25
19.17
19.17
18.87

	Probes
ı. Velocity in ft/s	
	18.80

IP7_040128

3D PROBE WORK SHEET

PROJECT:--- **Inter-Mountain** **OFA SE**
Date:.... **4/2/2003**
Load:...... **Damper 2/3**

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		685				
AVERAGE PRESSURE IN. W.C. (Pg)		1.37				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.10	25.10	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	35.52	29.04	
ACTUAL STACK VOLUME (Q acfm) =	136,738	111,801	-18.24
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	52,898	43,251	-18.24
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	52,898	43,251	-18.24
FLOW IN LBS/HR (wet) =	238460	194972	-18.24
FLOW IN LBS/HR (dry) =	238460	194972	-18.24

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.029065
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

IP7_040129

Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In. W.C.	P23-Patm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.074	-5.00	685	0.062	-0.03	1.36	1.4	-0.005	-0.000	1.36	1.41	-0.484	-30.326	1.128	0.070	30.70	24.40
	2	0.072	-2.00	685	0.061	-0.05	1.44	1.48	0.046	0.002	1.44	1.49	-0.820	-48.745	0.578	0.035	48.78	13.27
	3	0.077	-3.00	685	0.069	-0.02	1.74	1.77	0.000	0.000	1.74	1.78	-0.290	-18.777	1.020	0.070	19.01	26.90
	4	0.073	4.00	685	0.095	-0.05	1.44	1.44	-0.005	-0.001	1.44	1.44	-0.526	-30.566	1.132	0.108	30.80	30.21
	5	0.077	4.00	685	0.118	-0.081	1.39	1.38	0.000	0.000	1.39	1.38	-0.771	-18.997	1.021	0.121	19.40	35.13
	6	0.075	11.00	685	0.134	-0.054	1.45	1.42	-0.005	-0.001	1.45	1.41	-0.478	-30.155	1.126	0.151	31.92	35.37
	7	0.074	11.00	685	0.146	-0.025	1.63	1.59	0.000	0.000	1.63	1.58	-0.171	-12.043	0.995	0.145	16.26	39.25
2	1	0.076	-8.00	685	0.052	-0.036	1.2	1.26	0.001	0.000	1.20	1.27	-0.692	-14.904	1.004	0.052	16.87	23.46
	2	0.076	-4.00	685	0.061	-0.034	1.23	1.27	-0.005	-0.000	1.23	1.28	-0.557	-29.528	1.118	0.068	29.77	24.32
	3	0.074	-1.00	685	0.057	-0.025	1.39	1.43	-0.002	-0.000	1.39	1.44	-0.373	-24.351	1.059	0.071	24.37	26.03
	4	0.074	1.00	685	0.087	-0.033	1.42	1.43	-0.001	-0.000	1.42	1.43	-0.340	-22.086	1.041	0.101	22.11	31.57
	5	0.077	5.00	685	0.123	-0.037	1.33	1.31	0.000	0.000	1.33	1.31	-0.301	-19.471	1.024	0.126	20.08	35.76
	6	0.072	8.00	685	0.155	-0.031	1.49	1.44	0.001	0.000	1.49	1.43	-0.200	-13.609	1.000	0.155	15.75	40.64
	7	0.073	20.00	685	0.185	-0.016	1.5	1.42	-0.001	-0.000	1.50	1.41	-0.086	-6.981	0.984	0.182	21.14	42.68
3	1	0.072	12.00	685	0.057	0	1.46	1.51	-0.005	-0.000	1.46	1.52	0.000	-0.424	0.974	0.056	12.01	24.72
	2	0.071	8.00	685	0.069	0.006	1.54	1.57	-0.009	-0.001	1.54	1.58	0.087	7.282	0.975	0.067	10.80	27.33
	3	0.073	2.00	685	0.059	0.006	1.21	1.26	-0.010	-0.001	1.21	1.27	0.102	8.588	0.977	0.058	8.82	25.45
	4	0.072	6.00	685	0.07	-0.001	1.34	1.37	-0.004	-0.000	1.34	1.38	-0.014	-1.611	0.975	0.068	6.21	27.87
	5	0.07	13.00	685	0.109	-0.002	1.4	1.4	-0.004	-0.000	1.40	1.40	-0.018	-1.942	0.976	0.106	13.14	34.07
	6	0.072	20.00	685	0.154	0.003	1.47	1.42	-0.006	-0.001	1.47	1.41	0.019	1.249	0.973	0.150	20.04	39.02
	7	0.07	28.00	685	0.199	0.003	1.58	1.49	-0.006	-0.001	1.58	1.47	0.015	0.866	0.973	0.194	28.01	41.68
4	1	0.074	1.00	685	0.137	0.024	1.32	1.28	-0.011	-0.001	1.32	1.27	0.175	14.472	0.991	0.136	14.51	38.27
	2	0.075	3.00	685	0.114	0.025	1.29	1.28	-0.010	-0.001	1.29	1.28	0.219	17.166	1.001	0.114	17.42	34.59
	3	0.077	1.00	685	0.08	0.025	1.23	1.26	-0.010	-0.001	1.23	1.27	0.313	20.358	1.018	0.081	20.38	28.71
	4	0.076	6.00	685	0.078	0.021	1.18	1.2	-0.010	-0.001	1.18	1.20	0.269	19.259	1.012	0.079	20.14	28.30
	5	0.074	10.00	685	0.112	0.021	1.37	1.36	-0.011	-0.001	1.37	1.36	0.188	15.300	0.994	0.111	18.21	34.00
	6	0.071	14.00	685	0.158	0.024	1.45	1.4	-0.011	-0.002	1.45	1.39	0.152	12.762	0.985	0.156	18.86	40.06
	7	0.072	15.00	685	0.184	0.017	1.42	1.35	-0.009	-0.002	1.42	1.34	0.092	7.766	0.976	0.180	16.85	43.50
5	1	0.071	3.00	685	0.162	0.039	1.21	1.15	-0.010	-0.002	1.21	1.14	0.241	18.189	1.006	0.163	18.43	41.10
	2	0.07	5.00	685	0.171	0.04	1.2	1.14	-0.010	-0.002	1.20	1.13	0.234	17.884	1.005	0.172	18.55	42.17
	3	0.073	5.00	685	0.143	0.044	1.25	1.21	-0.010	-0.001	1.25	1.20	0.308	20.259	1.018	0.146	20.84	38.26
	4	0.07	7.00	685	0.145	0.047	1.26	1.22	-0.010	-0.001	1.26	1.21	0.324	20.579	1.020	0.148	21.69	38.34
	5	0.07	12.00	685	0.158	0.046	1.39	1.34	-0.010	-0.002	1.39	1.33	0.291	19.882	1.015	0.160	23.10	39.53
	6	0.07	10.00	685	0.172	0.04	1.41	1.34	-0.010	-0.002	1.41	1.33	0.233	17.821	1.004	0.173	20.36	41.81
	7	0.072	9.00	685	0.186	0.018	1.46	1.38	-0.009	-0.002	1.46	1.37	0.097	8.154	0.976	0.182	12.12	44.69
6	1	0.076	2.00	685	0.2	0.028	1.63	1.54	-0.010	-0.002	1.63	1.52	0.140	11.825	0.983	0.197	11.99	46.52
	2	0.078	2.00	685	0.21	0.047	1.5	1.39	-0.010	-0.002	1.50	1.37	0.224	17.397	1.002	0.210	17.51	46.94
	3	0.076	2.00	685	0.203	0.063	1.4	1.3	-0.010	-0.002	1.40	1.28	0.310	20.314	1.018	0.207	20.41	45.71
	4	0.072	3.00	685	0.199	0.071	1.41	1.31	-0.010	-0.002	1.41	1.29	0.357	21.157	1.023	0.204	21.36	45.09
	5	0.071	7.00	685	0.176	0.061	1.49	1.41	-0.010	-0.002	1.49	1.40	0.347	20.974	1.022	0.180	22.06	42.17
	6	0.072	9.00	685	0.151	0.036	1.47	1.42	-0.010	-0.002	1.47	1.41	0.238	18.087	1.006	0.152	20.14	39.25
	7	0.074	9.00	685	0.174	0.006	1.41	1.34	-0.007	-0.001	1.41	1.33	0.034	2.570	0.973	0.169	9.36	43.56

Avg. Duct Static = 1.37

	Average Temp.
Yaw Avg. =6.31	
Std. Dev. =7.06	685

		Traverse
Pitch Avg. =0.85	Result Angle Avg. =19.77	Avg. Velocity in ft/s
Std. Dev. =19.11	Std. Dev. =7.42	35.52

IP7_040130

Probes Point Velocity
29.18
28.78
29.75
28.98
29.77
29.38
29.17
29.58
29.58
29.18
29.18
29.77
28.78
28.98
28.78
28.58
28.99
28.79
28.38
28.79
28.38
29.19
29.38
29.77
29.58
29.18
28.59
28.79
28.60
28.39
28.99
28.39
28.39
28.39
28.79
29.57
29.96
29.58
28.79
28.59
28.79
29.19

	Probes
ı. Velocity in ft/s	
	29.04

IP7_040132

3D PROBE WORK SHEET

PROJECT:--- Inter-Mountain **OFA SE**
Date:.... 4/2/2003
Load:...... Damper 1/3

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		685				
AVERAGE PRESSURE IN. W.C. (Pg)		1.65				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.12	25.12	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	46.40	38.37	
ACTUAL STACK VOLUME (Q acfm) =	178,632	147,742	-17.29
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	69,161	57,202	-17.29
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	69,161	57,202	-17.29
FLOW IN LBS/HR (wet) =	311772	257862	-17.29
FLOW IN LBS/HR (dry) =	311772	257862	-17.29

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.029089
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

IP7_040133

Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In. W.C.	P23-Patm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.128	-4.00	685	0.063	0	1.76	1.81	-0.005	-0.000	1.76	1.82	0.000	-0.424	0.974	0.052	4.02	24.30
	2	0.131	0.00	685	0.106	0	1.8	1.79	-0.005	-0.000	1.80	1.79	0.000	-0.424	0.974	0.103	0.42	34.46
	3	0.128	0.00	685	0.124	0	1.8	1.78	-0.005	-0.001	1.80	1.78	0.000	-0.424	0.974	0.121	0.42	37.27
	4	0.128	5.00	685	0.155	0	1.72	1.67	-0.005	-0.001	1.72	1.66	0.000	-0.424	0.974	0.151	5.02	41.51
	5	0.129	9.00	685	0.191	-0.139	1.73	1.64	0.001	0.000	1.73	1.62	-0.728	-12.949	0.998	0.191	15.73	45.07
	6	0.129	0.00	685	0.227	-0.116	1.86	1.74	-0.005	-0.001	1.86	1.72	-0.511	-30.682	1.133	0.257	30.68	46.78
	7	0.129	8.00	685	0.255	-0.048	2.02	1.86	0.001	0.000	2.02	1.83	-0.188	-12.970	0.998	0.254	15.20	52.19
2	1	0.128	8.00	686	0.096	-0.05	1.51	1.52	-0.005	-0.001	1.51	1.52	-0.526	-30.566	1.132	0.108	31.50	29.99
	2	0.128	6.00	686	0.102	-0.042	1.62	1.62	-0.003	-0.000	1.62	1.62	-0.412	-26.921	1.085	0.111	27.35	31.69
	3	0.124	-10.00	685	0.112	-0.044	1.75	1.74	-0.002	-0.000	1.75	1.74	-0.393	-25.691	1.072	0.120	27.44	32.97
	4	0.129	8.00	685	0.144	-0.051	1.74	1.68	-0.001	-0.000	1.74	1.68	-0.354	-23.044	1.048	0.151	24.32	37.96
	5	0.133	15.00	685	0.194	-0.062	1.73	1.63	-0.000	-0.000	1.73	1.61	-0.320	-20.696	1.031	0.200	25.37	43.34
	6	0.125	15.00	685	0.249	-0.052	1.72	1.67	0.001	0.000	1.72	1.54	-0.209	-14.090	1.001	0.249	20.47	50.17
	7	0.127	27.00	685	0.312	-0.032	1.89	1.87	-0.001	-0.000	1.89	1.63	-0.103	-8.028	0.986	0.308	28.08	52.47
3	1	0.122	15.00	685	0.128	-0.001	1.69	1.66	-0.004	-0.001	1.69	1.65	-0.008	-1.078	0.975	0.125	15.04	36.58
	2	0.122	12.00	685	0.122	0.012	1.69	1.67	-0.009	-0.001	1.69	1.67	0.098	8.294	0.976	0.119	14.55	35.82
	3	0.128	12.00	685	0.104	0.017	1.57	1.57	-0.011	-0.001	1.57	1.57	0.163	13.633	0.988	0.103	18.09	32.68
	4	0.129	12.00	686	0.123	0	1.75	1.73	-0.005	-0.001	1.75	1.73	0.000	-0.424	0.974	0.120	12.01	36.31
	5	0.126	17.00	686	0.18	0	1.73	1.65	-0.005	-0.001	1.73	1.64	0.000	-0.424	0.974	0.175	17.01	42.95
	6	0.125	23.00	685	0.274	0.004	1.8	1.63	-0.006	-0.001	1.80	1.60	0.015	0.824	0.973	0.267	23.01	50.98
	7	0.129	30.00	685	0.336	0.002	1.88	1.64	-0.005	-0.002	1.88	1.60	0.006	0.081	0.974	0.327	30.00	53.13
4	1	0.128	0.00	685	0.218	0.033	1.65	1.53	-0.011	-0.002	1.65	1.51	0.151	12.722	0.985	0.215	12.72	48.49
	2	0.132	8.00	685	0.181	0.044	1.6	1.52	-0.010	-0.002	1.60	1.51	0.243	18.289	1.007	0.182	19.91	43.05
	3	0.128	5.00	685	0.153	0.041	1.73	1.67	-0.010	-0.002	1.73	1.66	0.268	19.219	1.011	0.155	19.83	39.68
	4	0.128	5.00	685	0.135	0.03	1.66	1.63	-0.010	-0.001	1.66	1.62	0.222	17.317	1.002	0.135	18.00	37.51
	5	0.132	20.00	685	0.213	0.038	1.62	1.51	-0.011	-0.002	1.62	1.49	0.178	14.694	0.991	0.211	24.64	44.80
	6	0.127	20.00	685	0.277	0.038	1.81	1.64	-0.010	-0.003	1.81	1.61	0.137	11.598	0.982	0.272	23.00	51.50
	7	0.132	22.00	685	0.311	0.026	1.89	1.67	-0.009	-0.003	1.89	1.63	0.084	6.982	0.975	0.303	23.03	54.34
5	1	0.123	3.00	685	0.31	0.051	1.83	1.61	-0.011	-0.003	1.83	1.57	0.165	13.710	0.988	0.306	14.03	57.59
	2	0.123	6.00	685	0.294	0.058	1.73	1.54	-0.011	-0.003	1.73	1.51	0.197	15.917	0.996	0.293	16.98	55.51
	3	0.126	8.00	685	0.261	0.067	1.65	1.49	-0.010	-0.003	1.65	1.46	0.257	18.828	1.009	0.263	20.40	51.60
	4	0.13	18.00	685	0.278	0.073	1.75	1.57	-0.010	-0.003	1.75	1.54	0.263	19.038	1.010	0.281	25.97	51.11
	5	0.125	12.00	685	0.29	0.069	1.79	1.6	-0.010	-0.003	1.79	1.57	0.238	18.066	1.005	0.292	21.58	53.86
	6	0.124	15.00	685	0.292	0.057	1.79	1.6	-0.011	-0.003	1.79	1.57	0.195	15.789	0.995	0.291	21.65	53.74
	7	0.128	13.00	686	0.302	0.028	1.97	1.77	-0.009	-0.003	1.97	1.73	0.086	7.205	0.975	0.294	14.83	56.24
6	1	0.136	2.00	685	0.325	0.044	1.99	1.77	-0.010	-0.003	1.99	1.73	0.135	11.451	0.982	0.319	11.62	59.33
	2	0.13	2.00	685	0.347	0.063	2.02	1.77	-0.011	-0.004	2.02	1.73	0.182	14.907	0.992	0.344	15.04	60.76
	3	0.126	2.00	685	0.335	0.092	2.04	1.8	-0.010	-0.003	2.04	1.76	0.275	19.428	1.013	0.339	19.53	58.86
	4	0.131	3.00	685	0.331	0.1	1.91	1.68	-0.010	-0.003	1.91	1.64	0.302	20.140	1.017	0.337	20.35	58.33
	5	0.128	7.00	685	0.305	0.086	2.02	1.81	-0.010	-0.003	2.02	1.77	0.282	19.640	1.014	0.309	20.80	55.74
	6	0.135	9.00	685	0.265	0.049	2.05	1.89	-0.011	-0.003	2.05	1.86	0.185	15.130	0.993	0.263	17.55	52.43
	7	0.128	9.00	685	0.284	0.009	1.93	1.74	-0.006	-0.002	1.93	1.71	0.032	2.322	0.973	0.276	9.29	55.63

Avg. Duct Static = 1.65

	Average Temp.
Yaw Avg. =9.43	
Std. Dev. =8.35	685

		Traverse
Pitch Avg. =3.00	Result Angle Avg. = 18.49	Avg. Velocity in ft/s
Std. Dev. =15.46	Std. Dev. =7.53	46.40

IP7_040134

Probes Point Velocity
38.51
38.81
38.36
38.37
38.52
38.51
38.51
38.52
38.37
37.76
38.51
39.11
37.92
38.22
37.46
37.46
38.37
38.51
38.07
37.92
38.52
38.37
38.97
38.37
38.37
38.97
38.22
38.96
37.61
37.62
38.08
38.67
37.92
37.77
38.36
39.54
38.66
38.06
38.81
38.36
39.39
38.36

	Probes
ı. Velocity in ft/s	
	38.37

IP7_040136

3D PROBE WORK SHEET

PROJECT:--- **Inter-Mountain** **OFA SW**
Date:.... **4/2/2003**
Load:...... **Damper 1/3**

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		659				
AVERAGE PRESSURE IN. W.C. (Pg)		1.94				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.14	25.14	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	30.10	25.44	
ACTUAL STACK VOLUME (Q acfm) =	115,880	97,961	-15.46
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	45,948	38,843	-15.46
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	45,948	38,843	-15.46
FLOW IN LBS/HR (wet) =	207130	175101	-15.46
FLOW IN LBS/HR (dry) =	207130	175101	-15.46

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.029791
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

IP7_040137

<date>

Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In. W.C.	P23-Patm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.056	5.00	659	0.046	-0.02	2.01	2.07	-0.004	-0.000	2.01	2.08	-0.435	-28.285	1.102	0.051	28.69	20.92
	2	0.054	3.00	659	0.051	-0.02	1.95	2.01	-0.002	-0.000	1.95	2.02	-0.392	-25.644	1.071	0.055	25.81	22.30
	3	0.053	11.00	659	0.057	-0.038	1.92	1.96	0.000	0.000	1.92	1.97	-0.667	-17.951	1.016	0.058	20.96	23.82
	4	0.058	4.00	659	0.068	-0.04	1.8	1.94	-0.003	-0.000	1.90	1.95	-0.588	-27.362	1.090	0.074	27.63	25.56
	5	0.055	5.00	659	0.075	-0.038	1.75	1.78	-0.005	-0.000	1.75	1.79	-0.507	-30.671	1.133	0.085	31.04	26.48
	6	0.055	2.00	659	0.085	-0.028	1.82	1.84	-0.000	-0.000	1.82	1.84	-0.329	-21.353	1.035	0.088	21.44	29.27
	7	0.058	1.00	659	0.104	-0.012	1.97	1.97	-0.000	-0.000	1.97	1.97	-0.115	-8.828	0.987	0.103	8.88	33.55
2	1	0.059	13.00	659	0.027	-0.017	1.77	1.85	-0.001	-0.000	1.77	1.86	-0.630	-22.840	1.046	0.028	26.11	15.99
	2	0.06	2.00	659	0.036	-0.023	1.82	1.89	-0.001	-0.000	1.82	1.90	-0.639	-21.645	1.037	0.037	21.73	19.02
	3	0.06	6.00	659	0.06	-0.022	1.88	1.93	-0.002	-0.000	1.88	1.94	-0.367	-23.906	1.055	0.063	24.60	24.24
	4	0.06	11.00	659	0.073	-0.02	1.87	1.9	0.001	0.000	1.87	1.91	-0.274	-17.800	1.016	0.074	20.83	26.97
	5	0.06	10.00	659	0.094	-0.02	1.92	1.93	0.001	0.000	1.92	1.93	-0.213	-14.305	1.002	0.094	17.39	31.04
	6	0.063	3.00	659	0.116	-0.011	1.99	1.98	-0.001	-0.000	1.99	1.98	-0.095	-7.530	0.985	0.114	8.10	35.45
	7	0.06	-2.00	659	0.14	-0.002	1.96	1.92	-0.004	-0.001	1.96	1.91	-0.014	-1.611	0.975	0.137	2.57	39.12
3	1	0.06	-10.00	659	0.025	-0.001	1.84	1.92	-0.003	-0.000	1.84	1.93	-0.040	-3.650	0.978	0.024	10.64	16.28
	2	0.055	7.00	659	0.032	0.002	1.86	1.93	-0.008	-0.000	1.86	1.94	0.063	5.083	0.973	0.031	8.64	18.49
	3	0.055	2.00	659	0.039	-0.001	1.75	1.82	-0.003	-0.000	1.75	1.83	-0.026	-2.528	0.976	0.038	3.22	20.65
	4	0.053	0.00	659	0.067	0.001	1.92	1.95	-0.006	-0.000	1.92	1.96	0.015	0.853	0.973	0.065	0.85	27.06
	5	0.052	-5.00	659	0.076	0	1.81	1.84	-0.005	-0.000	1.81	1.85	0.000	-0.424	0.974	0.074	5.02	28.73
	6	0.05	-9.00	659	0.109	-0.001	1.74	1.74	-0.004	-0.000	1.74	1.74	-0.009	-1.191	0.975	0.106	9.08	34.12
	7	0.055	-15.00	659	0.133	0.002	1.94	1.91	-0.006	-0.001	1.94	1.90	0.015	0.862	0.973	0.129	15.02	36.83
4	1	0.048	0.00	659	0.036	0.006	1.83	1.9	-0.011	-0.000	1.83	1.91	0.167	13.867	0.989	0.036	13.87	19.41
	2	0.06	2.00	659	0.06	0.019	1.85	1.9	-0.010	-0.001	1.85	1.91	0.317	20.439	1.019	0.061	20.53	24.54
	3	0.06	6.00	659	0.067	0.023	2.01	2.06	-0.010	-0.001	2.01	2.07	0.343	20.916	1.022	0.068	21.72	25.75
	4	0.06	12.00	659	0.083	0.024	1.8	1.82	-0.010	-0.001	1.80	1.82	0.289	19.832	1.015	0.084	23.05	28.31
	5	0.067	9.00	659	0.095	0.019	2.15	2.16	-0.011	-0.001	2.15	2.16	0.200	16.082	0.997	0.095	18.37	30.93
	6	0.072	2.00	659	0.134	0.023	2.37	2.34	-0.011	-0.001	2.37	2.33	0.172	14.223	0.990	0.133	14.36	37.36
	7	0.074	-15.00	659	0.153	0.015	2.41	2.36	-0.009	-0.001	2.41	2.35	0.098	8.266	0.976	0.149	17.08	39.12
5	1	0.07	6.00	659	0.155	0.05	2.33	2.28	-0.010	-0.002	2.33	2.27	0.323	20.550	1.019	0.158	21.37	39.21
	2	0.063	4.00	659	0.146	0.057	2.23	2.19	-0.010	-0.001	2.23	2.18	0.390	21.915	1.029	0.150	22.26	37.99
	3	0.061	5.00	659	0.114	0.047	2.11	2.1	-0.010	-0.001	2.11	2.10	0.412	22.662	1.034	0.118	23.18	33.44
	4	0.059	5.00	659	0.107	0.046	2.03	2.03	-0.009	-0.001	2.03	2.03	0.430	23.496	1.041	0.111	23.99	32.31
	5	0.057	-5.00	659	0.122	0.049	1.98	1.96	-0.010	-0.001	1.98	1.96	0.402	22.265	1.031	0.126	22.79	34.65
	6	0.059	-7.00	659	0.135	0.05	1.97	1.93	-0.010	-0.001	1.97	1.92	0.370	21.425	1.025	0.138	22.49	36.43
	7	0.056	-2.00	659	0.136	0.031	1.91	1.88	-0.010	-0.001	1.91	1.87	0.228	17.601	1.003	0.136	17.71	37.29
6	1	0.055	0.00	659	0.154	0.045	1.78	1.73	-0.010	-0.002	1.78	1.72	0.292	19.908	1.015	0.156	19.91	39.41
	2	0.05	-3.00	659	0.124	0.05	1.76	1.74	-0.010	-0.001	1.76	1.74	0.403	22.320	1.032	0.128	22.51	35.02
	3	0.052	2.00	659	0.136	0.065	1.83	1.8	-0.009	-0.001	1.83	1.79	0.478	27.297	1.080	0.147	27.36	36.07
	4	0.05	2.00	659	0.134	0.062	1.92	1.89	-0.009	-0.001	1.92	1.88	0.463	25.806	1.063	0.142	25.88	35.99
	5	0.053	-2.00	659	0.132	0.056	1.82	1.79	-0.009	-0.001	1.82	1.78	0.424	23.201	1.039	0.137	23.28	36.05
	6	0.056	-3.00	659	0.122	0.035	1.76	1.74	-0.010	-0.001	1.76	1.74	0.287	19.773	1.015	0.124	19.99	35.05
	7	0.054	3.00	659	0.107	0.009	1.89	1.89	-0.009	-0.001	1.89	1.89	0.084	7.028	0.975	0.104	7.64	33.92

Avg. Duct Static = 1.94

	Average Temp.
Yaw Avg. =1.45	
Std. Dev. =6.54	659

		Traverse Avg. Velocity in ft/s
Pitch Avg. =3.29	Result Angle Avg. =18.28	
Std. Dev. =18.63	Std. Dev. =7.72	30.10

IP7_040138

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Probes Point Velocity
25.07
24.62
24.39
25.52
24.86
24.86
25.52
25.74
25.96
25.96
25.96
25.96
26.60
25.96
25.96
24.85
24.86
24.40
24.17
23.70
24.85
23.22
25.96
25.95
25.96
27.42
28.42
28.81
28.02
26.59
26.17
25.74
25.30
25.74
25.08
24.86
23.70
24.17
23.70
24.40
25.08
24.63

	Probes
ј. Velocity in ft/s	
	25.44

IP7_040140

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3D PROBE WORK SHEET

PROJECT:--- **Inter-Mountain** **OFA SW**
Date:.... **4/2/2003**
Load:...... **Damper 2/3**

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		662				
AVERAGE PRESSURE IN. W.C. (Pg)		1.29				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.09	25.09	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	41.44	36.89	
ACTUAL STACK VOLUME (Q acfm) =	159,543	142,024	-10.98
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	62,971	56,056	-10.98
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	62,971	56,056	-10.98
FLOW IN LBS/HR (wet) =	283868	252696	-10.98
FLOW IN LBS/HR (dry) =	283868	252696	-10.98

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.029654
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

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Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In. W.C.	P23-Patm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.126	2.00	662	0.052	-0.02	1.34	1.39	-0.002	-0.000	1.34	1.40	-0.385	-25.136	1.066	0.055	25.21	22.62
	2	0.123	15.00	662	0.08	-0.02	1.34	1.36	0.001	0.000	1.34	1.36	-0.250	-16.386	1.010	0.081	22.08	27.97
	3	0.133	6.00	662	0.091	-0.058	1.27	1.28	-0.001	-0.000	1.27	1.28	-0.637	-21.844	1.039	0.095	22.61	30.15
	4	0.13	5.00	662	0.113	-0.066	1.47	1.45	-0.004	-0.000	1.47	1.45	-0.584	-27.720	1.095	0.124	28.13	32.93
	5	0.123	4.00	662	0.131	-0.068	1.53	1.5	-0.005	-0.001	1.53	1.49	-0.519	-30.652	1.133	0.148	30.89	35.11
	6	0.121	-3.00	662	0.16	-0.052	1.46	1.4	-0.000	-0.000	1.46	1.39	-0.325	-21.057	1.033	0.165	21.26	40.24
	7	0.118	-8.00	662	0.19	-0.019	1.32	1.24	-0.001	-0.000	1.32	1.23	-0.100	-7.864	0.985	0.187	11.20	45.08
2	1	0.111	7.00	662	0.063	-0.03	1.2	1.23	-0.005	-0.000	1.20	1.24	-0.476	-30.112	1.126	0.071	30.84	24.29
	2	0.122	2.00	662	0.068	-0.028	1.15	1.19	-0.003	-0.000	1.15	1.20	-0.412	-26.921	1.085	0.074	26.99	25.71
	3	0.117	6.00	662	0.084	-0.023	1.27	1.3	0.001	0.000	1.27	1.31	-0.274	-17.790	1.016	0.085	18.46	29.43
	4	0.109	6.00	662	0.102	-0.025	1.14	1.14	0.001	0.000	1.14	1.14	-0.245	-16.105	1.008	0.103	17.16	32.56
	5	0.112	0.00	662	0.135	-0.018	1.37	1.34	-0.000	-0.000	1.37	1.33	-0.133	-9.903	0.990	0.134	9.90	38.24
	6	0.116	-8.00	662	0.173	-0.012	1.4	1.33	-0.002	-0.000	1.40	1.32	-0.069	-5.808	0.981	0.170	9.87	43.11
	7	0.116	-4.00	662	0.218	-0.003	1.42	1.3	-0.004	-0.001	1.42	1.28	-0.014	-1.568	0.975	0.213	4.30	48.84
3	1	0.114	-1.00	662	0.097	0.002	1.34	1.35	-0.006	-0.001	1.34	1.35	0.021	1.348	0.973	0.094	1.68	32.62
	2	0.115	-3.00	662	0.094	0.009	1.11	1.11	-0.009	-0.001	1.11	1.11	0.096	8.063	0.976	0.092	8.60	31.82
	3	0.118	2.00	662	0.091	0.011	1.24	1.25	-0.010	-0.001	1.24	1.25	0.121	10.245	0.979	0.089	10.44	31.19
	4	0.118	2.00	662	0.092	0.013	1.31	1.32	-0.010	-0.001	1.31	1.32	0.141	11.929	0.983	0.090	12.09	31.23
	5	0.125	-5.00	662	0.136	0.011	1.36	1.33	-0.009	-0.001	1.36	1.32	0.081	6.738	0.974	0.133	8.38	38.25
	6	0.12	-12.00	662	0.189	0.014	1.35	1.26	-0.009	-0.002	1.35	1.24	0.074	6.126	0.974	0.184	13.45	44.32
	7	0.132	-14.00	662	0.245	0.013	1.42	1.27	-0.008	-0.002	1.42	1.24	0.053	4.233	0.973	0.238	14.61	50.18
4	1	0.129	0.00	662	0.175	0.043	1.39	1.31	-0.010	-0.002	1.39	1.30	0.246	18.399	1.007	0.176	18.40	42.31
	2	0.126	4.00	662	0.184	0.043	1.47	1.39	-0.010	-0.002	1.47	1.38	0.234	17.874	1.004	0.185	18.30	43.35
	3	0.127	0.00	662	0.165	0.038	1.36	1.3	-0.010	-0.002	1.36	1.29	0.230	17.715	1.004	0.166	17.71	41.17
	4	0.122	2.00	662	0.149	0.044	1.26	1.22	-0.010	-0.002	1.26	1.21	0.295	19.983	1.016	0.151	20.08	38.82
	5	0.12	0.00	662	0.158	0.045	1.21	1.15	-0.010	-0.002	1.21	1.14	0.285	19.718	1.014	0.160	19.72	40.04
	6	0.122	-6.00	662	0.186	0.04	1.47	1.38	-0.010	-0.002	1.47	1.36	0.215	16.941	1.000	0.186	17.94	43.58
	7	0.12	-10.00	662	0.213	0.023	1.41	1.3	-0.010	-0.002	1.41	1.28	0.108	9.137	0.977	0.208	13.51	47.12
5	1	0.122	4.00	662	0.263	0.06	1.36	1.2	-0.010	-0.003	1.36	1.17	0.228	17.611	1.003	0.264	18.05	51.88
	2	0.113	2.00	662	0.239	0.075	1.3	1.16	-0.010	-0.002	1.30	1.14	0.314	20.383	1.018	0.243	20.48	49.10
	3	0.12	2.00	662	0.255	0.086	1.48	1.32	-0.010	-0.003	1.48	1.29	0.337	20.811	1.021	0.260	20.90	50.63
	4	0.116	0.00	662	0.233	0.083	1.35	1.21	-0.010	-0.002	1.35	1.19	0.356	21.147	1.023	0.238	21.15	48.38
	5	0.121	-4.00	662	0.247	0.086	1.33	1.19	-0.010	-0.002	1.33	1.17	0.348	21.002	1.022	0.253	21.36	49.71
	6	0.126	-2.00	662	0.247	0.071	1.49	1.34	-0.010	-0.003	1.49	1.31	0.287	19.788	1.015	0.251	19.88	50.00
	7	0.124	-6.00	662	0.238	0.047	1.32	1.18	-0.011	-0.003	1.32	1.16	0.197	15.929	0.996	0.237	16.99	49.46
6	1	0.124	-2.00	662	0.289	0.055	1.62	1.44	-0.011	-0.003	1.62	1.41	0.190	15.481	0.994	0.287	15.61	54.82
	2	0.118	2.00	662	0.292	0.069	1.6	1.41	-0.010	-0.003	1.60	1.38	0.236	17.993	1.005	0.293	18.10	54.68
	3	0.122	0.00	662	0.281	0.087	1.63	1.45	-0.010	-0.003	1.63	1.42	0.310	20.299	1.018	0.286	20.30	53.26
	4	0.125	0.00	662	0.274	0.087	1.59	1.41	-0.010	-0.003	1.59	1.38	0.318	20.455	1.019	0.279	20.46	52.57
	5	0.121	1.00	662	0.255	0.065	1.36	1.2	-0.010	-0.003	1.36	1.17	0.255	18.761	1.009	0.257	18.79	51.01
	6	0.117	-5.00	662	0.221	0.05	1.51	1.39	-0.010	-0.002	1.51	1.37	0.226	17.518	1.003	0.222	18.20	47.49
	7	0.115	3.00	662	0.187	0.007	1.44	1.35	-0.007	-0.001	1.44	1.33	0.037	2.832	0.973	0.182	4.12	45.18

Avg. Duct Static = 1.29

Yaw Avg. =-0.40	Average Temp.
Std. Dev. =5.47	662

Pitch Avg. =3.80	Result Angle Avg. =17.34	Traverse Avg. Velocity in ft/s
Std. Dev. =17.55	Std. Dev. =6.65	41.44

IP7_040142

Probes Point Velocity
37.70
37.25
38.73
38.29
37.24
36.94
36.49
35.39
37.10
36.33
35.07
35.54
36.17
36.17
35.86
36.03
36.49
36.48
37.55
36.80
38.59
38.15
37.70
37.85
37.10
36.80
37.09
36.79
37.10
35.71
36.79
36.18
36.95
37.70
37.41
37.39
36.48
37.09
37.55
36.95
36.33
36.02

	Probes
ı. Velocity in ft/s	
	36.89

IP7_040144

<date>

3D PROBE WORK SHEET

PROJECT:--- Inter-Mountain **OFA SW**
Date:.... 4/2/2003
Load:...... Damper 1/3 & 2/3

STD. TEMP. DEGREES F (t std)		68				
STD. BAROMETRIC PRESSURE " Hg (Pstd)		29.92				
DUCT SIZE (D)	Traverse	77.000	120.000	77.000	120.000	Flow Element
AVERAGE TEMPERATURE DEGREES F (ts)		685				
AVERAGE PRESSURE IN. W.C. (Pg)		1.68				
ACTUAL BAROMETRIC PRESSURE " Hg (Pbar)		25.00				
% O2 (20.95)		20.95				
% N2 (78.09)		78.09				
% CO2 (0.03)		0.03				
% CO (0.0)		0.00				
%A (0.93)		0.93				
% H2O (0.0)		0.00				

CALCULATIONS

	Traverse	Flow Elem.	% Difference
DRY MOLE FRACTION OF STACK (Mfd) =	1.000	1.000	
STACK PRESSURE " Hg (Ps) =	25.12	25.12	
DRY MOLECULAR WT. OF STACK GAS Lb / Lb -Mole(Md)=	28.966	28.966	
WET MOLECULAR WT. OF STACK GAS Lb / Lb -Mole (Ms)=	28.966	28.966	
STACK AREA SQ. FT (As) =	64.167	64.167	
STACK VELOCITY FT/ SEC. (Vs) =	52.71	47.30	
ACTUAL STACK VOLUME (Q acfm) =	202,931	182,093	-10.27
DRY STANDARD VOLUMETRIC STACK FLOW (Q scfmd) =	78,594	70,523	-10.27
WET STANDARD VOLUMETRIC STACK FLOW (Q scfmw) =	78,594	70,523	-10.27
FLOW IN LBS/HR (wet) =	354295	317912	-10.27
FLOW IN LBS/HR (dry) =	354295	317912	-10.27

GAS DENSITY AT ACTUAL CONDITIONS, LBS/CU.FT.(wet)	0.029098
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (wet)	0.075132
GAS DENSITY AT STANDARD CONDITIONS, LBS/CU.FT. (dry)	0.075132

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Port #	Depth#	Probes Vp In. W.C.	Measured Yaw Angle Degrees	Air Temp. °F	P1 - P23 In.W.C.	Pitch Press. P4 - P5 In.W.C.	P1-Patm (Pt) In. W.C.	P23-Patm Ps Choke In w.c.	From Chart P1-Pt/Pt-Ps TP Coeff.	TP Coeff. * Corrected Pv P1-Pt	(P1-Patm) Minus P1-Pt	P23 Corrected In w.c.	Calculated P4-P5/P1-P23 F1	From Chart Pitch Angle Degrees	From Chart Pt-Ps/P1-P23 (F2)^2	Corrected Pv Pt-Ps In.W.C.	Resultant Angle Degrees	Traverse Point Velocity
1	1	0.198	10.00	675	0.101	-0.05	1.56	1.56	-0.005	-0.001	1.56	1.56	-0.495	-30.553	1.132	0.114	32.00	30.62
	2	0.193	10.00	685	0.137	-0.096	1.7	1.66	0.001	0.000	1.70	1.65	-0.701	-14.119	1.001	0.137	17.24	37.94
	3	0.192	15.00	685	0.168	-0.105	1.83	1.76	-0.001	-0.000	1.83	1.75	-0.625	-23.419	1.051	0.177	27.58	39.93
	4	0.192	3.00	685	0.176	-0.1	1.87	1.79	-0.004	-0.001	1.87	1.78	-0.568	-28.899	1.109	0.195	29.04	41.42
	5	0.193	0.00	685	0.208	-0.109	1.87	1.76	-0.005	-0.001	1.87	1.74	-0.505	-30.661	1.133	0.236	30.66	44.78
	6	0.193	4.00	685	0.255	-0.075	1.92	1.76	0.000	0.000	1.92	1.73	-0.294	-19.045	1.022	0.261	19.45	51.61
	7	0.201	-5.00	685	0.309	-0.035	1.98	1.77	-0.000	-0.000	1.98	1.73	-0.113	-8.698	0.987	0.305	10.02	58.31
2	1	0.198	-4.00	686	0.098	-0.052	1.6	1.6	-0.005	-0.001	1.60	1.60	-0.531	-30.489	1.131	0.111	30.72	30.69
	2	0.202	14.00	685	0.111	-0.042	1.62	1.61	-0.002	-0.000	1.62	1.61	-0.378	-24.711	1.062	0.118	28.18	32.46
	3	0.191	13.00	686	0.127	-0.034	1.62	1.59	0.001	0.000	1.62	1.58	-0.268	-17.424	1.014	0.129	21.62	35.78
	4	0.194	9.00	686	0.174	-0.037	1.7	1.63	0.001	0.000	1.70	1.62	-0.213	-14.298	1.002	0.174	16.84	42.86
	5	0.192	-3.00	686	0.231	-0.038	1.79	1.66	0.000	0.000	1.79	1.64	-0.165	-11.672	0.994	0.230	12.05	50.26
	6	0.192	-4.00	685	0.295	-0.024	1.86	1.67	-0.001	-0.000	1.86	1.64	-0.081	-6.636	0.983	0.290	7.74	57.22
	7	0.194	-3.00	685	0.377	-0.009	2.08	1.8	-0.004	-0.001	2.08	1.75	-0.024	-2.387	0.976	0.368	3.83	64.90
3	1	0.199	-2.00	685	0.147	0.009	1.87	1.82	-0.008	-0.001	1.87	1.81	0.061	4.968	0.973	0.143	5.35	40.38
	2	0.195	1.00	685	0.156	0.013	1.85	1.79	-0.009	-0.001	1.85	1.78	0.083	6.958	0.975	0.152	7.03	41.49
	3	0.194	4.00	685	0.143	0.011	1.84	1.8	-0.009	-0.001	1.84	1.79	0.077	6.382	0.974	0.139	7.53	39.67
	4	0.195	5.00	685	0.143	0.015	1.82	1.78	-0.010	-0.001	1.82	1.77	0.105	8.868	0.977	0.140	10.17	39.45
	5	0.198	0.00	685	0.214	0.013	1.91	1.79	-0.008	-0.002	1.91	1.77	0.061	4.925	0.973	0.208	4.93	48.75
	6	0.192	-7.00	685	0.304	0.009	1.95	1.74	-0.006	-0.002	1.95	1.70	0.030	2.138	0.973	0.296	7.32	57.84
	7	0.195	-12.00	685	0.373	0.013	2.04	1.76	-0.007	-0.002	2.04	1.71	0.035	2.603	0.973	0.363	12.27	63.12
4	1	0.192	-1.00	685	0.278	0.052	1.84	1.66	-0.011	-0.003	1.84	1.63	0.187	15.271	0.993	0.276	15.30	54.36
	2	0.196	1.00	685	0.227	0.061	1.84	1.72	-0.010	-0.002	1.84	1.70	0.269	19.243	1.012	0.230	19.27	48.51
	3	0.196	4.00	685	0.226	0.061	1.88	1.75	-0.010	-0.002	1.88	1.73	0.270	19.281	1.012	0.229	19.68	48.28
	4	0.199	-1.00	685	0.237	0.064	1.9	1.76	-0.010	-0.002	1.90	1.74	0.270	19.285	1.012	0.240	19.31	49.55
	5	0.198	-3.00	685	0.259	0.06	1.99	1.84	-0.010	-0.003	1.99	1.81	0.232	17.779	1.004	0.260	18.02	51.99
	6	0.197	-20.00	685	0.307	0.057	1.74	1.53	-0.011	-0.003	1.74	1.49	0.186	15.180	0.993	0.305	24.92	53.71
	7	0.198	-20.00	685	0.357	0.039	2.05	1.79	-0.010	-0.003	2.05	1.74	0.109	9.247	0.978	0.349	21.95	58.75
5	1	0.186	6.00	685	0.417	0.1	2.02	1.69	-0.010	-0.004	2.02	1.63	0.240	18.148	1.006	0.419	19.08	65.64
	2	0.191	0.00	685	0.395	0.101	2	1.69	-0.010	-0.004	2.00	1.64	0.256	18.790	1.009	0.399	18.79	64.10
	3	0.193	3.00	685	0.354	0.113	2.05	1.8	-0.010	-0.004	2.05	1.76	0.319	20.487	1.019	0.361	20.70	60.24
	4	0.191	-3.00	685	0.382	0.123	2.1	1.81	-0.010	-0.004	2.10	1.76	0.322	20.539	1.019	0.389	20.75	62.57
	5	0.193	2.00	685	0.392	0.124	1.97	1.66	-0.010	-0.004	1.97	1.61	0.316	20.433	1.019	0.399	20.53	63.47
	6	0.197	-3.00	685	0.4	0.114	1.96	1.66	-0.010	-0.004	1.96	1.61	0.285	19.723	1.014	0.406	19.94	64.22
	7	0.197	0.00	686	0.385	0.071	1.99	1.7	-0.011	-0.004	1.99	1.65	0.184	15.098	0.993	0.382	15.10	64.01
6	1	0.198	4.00	685	0.459	0.084	1.97	1.6	-0.011	-0.005	1.97	1.54	0.183	15.004	0.992	0.456	15.52	69.75
	2	0.192	4.00	685	0.45	0.101	2.04	1.68	-0.010	-0.005	2.04	1.62	0.224	17.429	1.002	0.451	17.87	68.55
	3	0.193	8.00	685	0.445	0.128	2.01	1.66	-0.010	-0.005	2.01	1.60	0.288	19.793	1.015	0.452	21.29	67.15
	4	0.198	4.00	685	0.439	0.132	2.15	1.8	-0.010	-0.004	2.15	1.74	0.301	20.108	1.017	0.446	20.49	67.10
	5	0.198	2.00	685	0.416	0.113	2.08	1.75	-0.010	-0.004	2.08	1.69	0.272	19.356	1.012	0.420	19.46	65.53
	6	0.189	0.00	686	0.35	0.078	1.94	1.68	-0.010	-0.004	1.94	1.63	0.223	17.349	1.002	0.351	17.35	60.62
	7	0.188	2.00	685	0.284	0.014	1.83	1.65	-0.007	-0.002	1.83	1.62	0.049	3.894	0.973	0.276	4.38	56.21

Avg. Duct Static = 1.68

	Average Temp.
Yaw Avg. =0.88	
Std. Dev. =7.31	685

		Traverse
Pitch Avg. =3.22	Resul Angle Avg. =17.41	Avg. Velocity in ft/s
Std. Dev. =17.44	Std. Dev. =7.55	52.71

IP7_040146

IP7_040147

Probes Point Velocity
47.52
47.11
46.98
46.98
47.11
47.11
48.07
47.72
48.20
46.87
47.24
46.99
46.99
47.23
47.83
47.35
47.22
47.35
47.71
46.99
47.35
46.99
47.47
47.47
47.83
47.71
47.61
47.71
46.25
46.87
47.10
46.86
47.11
47.60
47.60
47.73
46.99
47.12
47.71
47.72
46.62
46.50

	Probes
;. Velocity in ft/s	
	[illegible]

IP7_040148

From: Ken Nielson
To: Phil Hailes
CC: James Nelson
Date: 6/28/2003 3:02 PM
Subject: OFA work on 6/27 & 28
Attachments: Over Fire Air Summary 6-27-28-03.doc

Attached is a summary of the work completed on the OFA system on Friday. Some additional inspection and testing was completed on Saturday.

PRELIMINARY OPTIMIZATION TEST MATRIX
INTERMOUNTAIN POWER UNIT 2 (100210)

Test #	Main Steam Flow (10^3 lb/hr)	Boiler Load (% MCR)	Approx. Generator Load (MWg)	Excess Air (%)	Target Total OFA Flow (10^3 lb/hr)	Approx. Burner Zone Stoich., SR_B	Maximum Allowable OFA Flow for SR_B = 0.95 (10^3 lb/hr)	OFA Damper(s) Open	Mill Out of Service	Data [1]
1	6,285	95	900	18	1,100	1.0	1,400	1/3 & 2/3	G	All
2				16	980		1,280			BR, B, G, FO, FA
3				13.5	825		1,125			
4	5,940	90	850	16	925		1,190			
5	4,950	75	710	18	550	1.06	1,090	2/3		
6	4,055	61	575	20	220	1.15	970	1/3		
7	6,750	102	950	16	1,040	1.0	1,360	1/3 & 2/3		All
8	6,285	95	900		optimum	optimum	1,280			BR, B, G, FO, FA
9	4,055	61	575	20			970	1/3		All
10	6,750	102	950	16			1,360	1/3 & 2/3	E	
11	6,285	95	900	18			1,400			BR, B, G, FO, FA
12				16			1,280			
13				13.5			1,125			
14	5,940	90	850	16			1,190			
15	4,950	75	710	18			1,090	2/3		
16	4,055	61	575	20			970	1/3		All

BR = burner data
B = boiler data
G= gas analysis grid data
FO = furnace observations
FA = fly ash sample
FL = fuel sample

Over Fire Air Summary from 6/27/03 & 6/28/03

The following repairs and observations were made on the OFA system on 6/27 & 6/28:

The wear sleeves/journals for each of the inboard bearings on the through-all shafts for the OFA damper linkages were installed. Each damper set was cycled full stroke to check for interference problems with the new sleeves. No problems related to the sleeves were found. The first set installed was checked manually before continuing to install the remaining sleeve sets. Then, all shafts were checked with powered operation.

During the powered checks, cracks were found on welds that secured the inside actuator arm to the through-wall shaft on the NW 2/3 damper set. The cracking was not easily detected but did allow slippage during attempted damper operation Rechecked that weld point on all damper sets and found similar cracks on the NW 1/3 dampers and the SE 2/3 dampers but without significant slippage.

The cracked welds were repaired and reinforced. As a safeguard, similar reinforcement was completed all of the remaining inside and most of the outside actuator arms on the through-wall shafts.

The reinforcements consisted of ensuring three radial stitch welds were on or placed on both sides of each of the above listed actuator arms. All dampers were then re-checked by cycling full stroke to ensure proper operation. No further problems with cracking or radial slippage of the linkage arms was detected.

Through the repair and testing described above, the following additional problems were observed with the operation of the OFA linkages:

- Almost all through-wall shafts displayed a minimum of ½" (and in some cases +1") of axial movement during actuation. There was also shaft movement indicating a significant bending moment on the through-wall shafts as well.
- All 1/3 damper sets had to be manually assisted to cycle through full stroke. The NW 1/3 damper set would only move from 0% (closed) to a maximum of 75% of full stroke with manual assistance. This linkage, including each link point and linkage member, was carefully inspected and checked for interference problems or other obstructions preventing full stroke. No silver bullet was found. It would appear to be a combination of binding and resistance over the linkage as a whole that was preventing further actuation.
- During actuation of the various damper sets, further deterioration of the pillow-block bearing journals was observed.
- A popping was detected at the initial opening and just before reaching the full closed position on the SE inlet (feeder) damper set.

410 Stainless rod was used on the bearing sleeve welds. 309 Stainless was used on the actuator arm repairs.

From: "Craig Mullen" <cmullen@gslelectric.com>
To: <kenneth-n@ipsc.com>
CC: "Mike Nuttall" <mike-n@ipsc.com>
Date: 1/22/2004 4:28 PM
Subject: Over-fire Air Nema 12 Raceway

Kenneth:

In accordance with your request and our walk through and discussion, we submit the following scope of work and pricing for your review.

1. Install 8" x 8" Nema 12 Hoffman wireway, three (3) locations on level 8 & 9 at the Over-fire Air / boiler areas. GSL will adequately support and tie these sections of wireway between Unit 2 cable trays.
2. GSL will have Mallory Engineering Company custom make three (3) transitional sections to fit between the column and the toe kick area. This transitional pieces will reduce from 8" to 5" and then back to 8" at the column areas.
3. This price includes all labor, material & equipment to complete this project in a timely manner.

TOTAL PRICE: $24,180.00

Thank You,

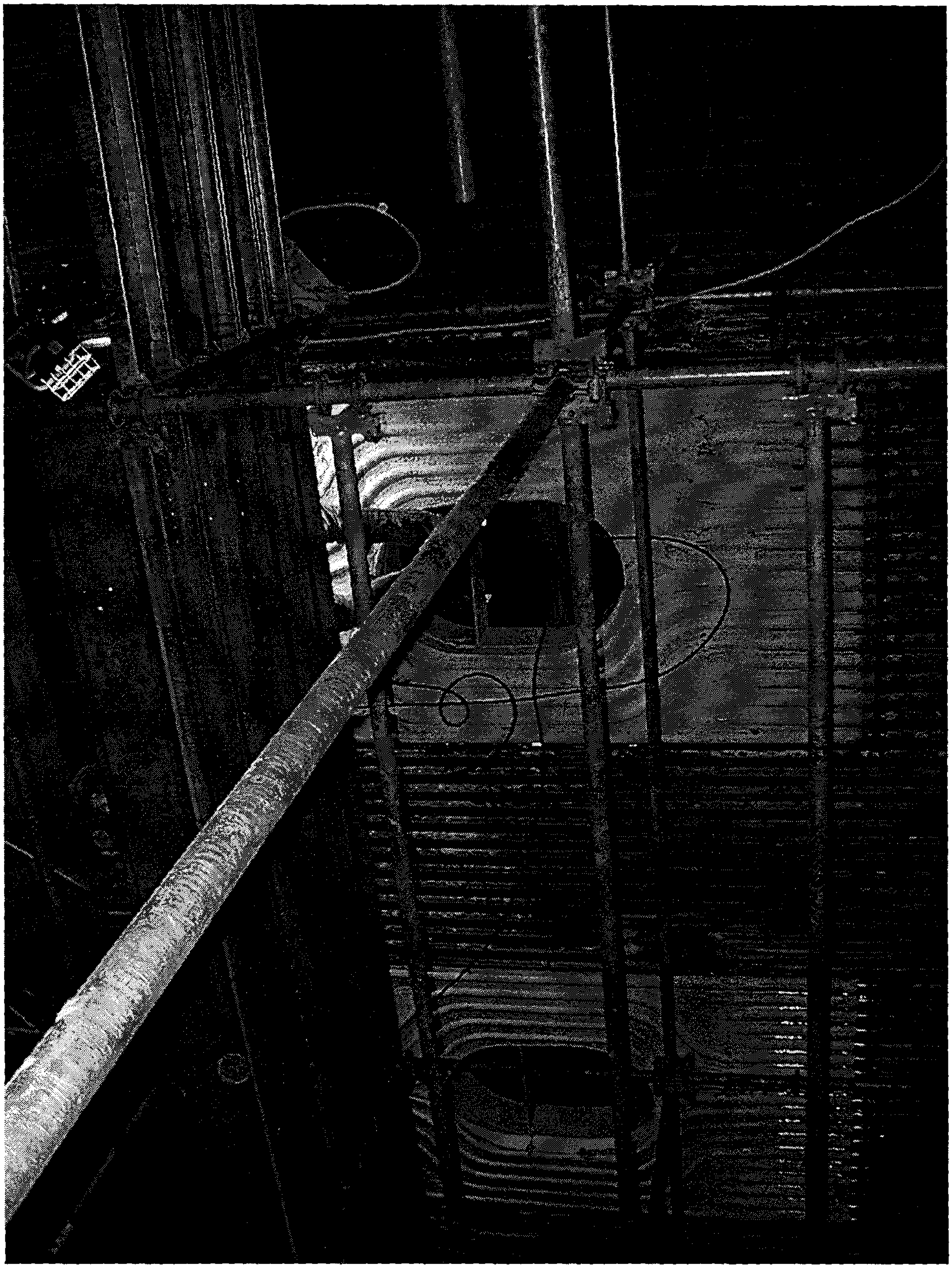
Craig Mullen

From: Kevin Miller
To: Ken Nielson
CC: Jon Christensen
Date: 1/28/2003 4:11 PM
Subject: Overfire Air Power Sources.

Dampers on the East side can be powered from 1APA-PPL-109 on the Boiler 8th floor near column H-104.

Dampers on the West side can be powered from 1APA-PPL-108 on the Boiler 8th floor near column H-106.

See 1APA-E1630 for both.



Primary Air Flow Traverse Test Results
31 Mar - 1 April 2003
Intermountain Power Plant Unit 1
w/ Dan Biestel of Air Monitor Corp and Jerry Finlinson
using 3D probes

Mill	Feeder Speed	Air Flow	Date	Test Temp	Baro Pres in Hg	DP in W.C	3D Travers Flow Calc	Pitot Flow Calc	Internal Pitot vs TRAVERSE % HIGH	Mill AVG	Start time	End time	PI AVG TEMP	PI AVG FLOW	CCS PI AVG FLOW % HIGH TRAVERSE	CCS PI AVG FLOW % HIGH PITOT
A	50															
A	75									1.08						
A	90	215,000	4/1/2003	385	27.67	2.2	194,616	196,712	**1.08**		17:59	18:38	390.85	199,694	**2.61**	**1.52**
B	50	186000	3/31/2003				172685	179108	**3.72**		8:20	9:05	313.91	189,064	**9.48**	**5.56**
B	75	213000	3/31/2003	323	28.3	2.02	204348	211200	**3.35**	3.37	9:28	10:02	345.14	214,311	**4.88**	**1.47**
B	90	228,800	3/31/2003	357	27.96	2.45	219,594	226,266	**3.04**		16:57	17:40	363.73	229,028	**4.30**	**1.22**
C	50	178,000	3/31/2003	306	28.03	1.4	174,078	176981	**1.67**		15:53	16:35	307.04	178751	**2.68**	**1.00**
C	75	202,800	3/31/2003	341	28.15	1.88	193160	198321	**2.67**	2.13	12:40	13:20	353.86	201242	**4.18**	**1.47**
C	90	233,000	3/31/2003	344	27.94	2.5	224566	229182	**2.06**		13:40	14:20	357.34	230287	**2.55**	**0.48**
D	50	186,000	3/31/2003	304	28.09	1.49	182800	184662	**1.02**		18:09	18:50	307.2	187,200	**2.41**	**1.37**
D	75									1.17						
D	90	226,000	3/31/2003	356	28.01	2.39	221,884	224,837	**1.33**		19:04	19:52	358.79	226,882	**2.25**	**0.91**
E	50	184,900	4/1/2003	295	27.67	1.6	184,635	184,721	**0.05**		16:46	17:20	290.47	185867	**0.67**	**0.62**
E	75									0.22						
E	90	225000	4/1/2003	351	27.55	2.55	224,296	225,166	**0.39**		15:21	15:55	360.46	226341	**0.91**	**0.52**
F	50	187,000	4/1/2003	337	27.82	1.57	180420	183,752	**1.85**		8:55	9:33	309.42	186537	**3.39**	**1.52**
F	75									2.03						
F	90	220,700	4/1/2003	388	27.69	2.36	215546	220338	**2.22**		7:56	8:45	389.85	222329	**3.15**	**0.90**
G	50	188,900	4/1/2003	278	27.98	1.48	181,678	185,839	**2.29**		11:03	11:37	303.56	189053	**4.06**	**1.73**
G	75									2.25						
G	90	227000	4/1/2003	364	27.85	2.45	220,568	225,432	**2.21**		10:15	10:50	375.79	228248	**3.48**	**1.25**
H	50															
H	75															
H	90															
Average									**1.93**						**3.40**	**1.44**

IP7_040155

U1 PA FLOW TRAVERSE TEST CCS PI AVERAGES - 31MAR03 & 1 APR03
This page has live PI links, the static values are on sheet3.

U1A 90%

01-Apr-03 17:59:00	FLOW	TEMP
01-Apr-03 18:38:00	1COAXI056A	1COAXI200A
01-Apr-03 17:59:00	215601.05930	336.23932
01-Apr-03 18:01:00	213365.36423	350.24170
01-Apr-03 18:03:00	213736.50758	370.55420
01-Apr-03 18:05:00	211976.96226	386.30789
01-Apr-03 18:07:00	209001.56946	397.94345
01-Apr-03 18:09:00	208114.17478	404.38211
01-Apr-03 18:11:00	201723.48475	407.52591
01-Apr-03 18:13:00	192704.23084	407.19937
01-Apr-03 18:15:00	195526.73069	406.05521
01-Apr-03 18:17:00	200222.12846	405.25162
01-Apr-03 18:19:00	199125.75293	404.50192
01-Apr-03 18:21:00	194966.50340	401.23434
01-Apr-03 18:23:00	192367.86635	396.83533
01-Apr-03 18:25:00	192809.49072	393.46747
01-Apr-03 18:27:00	193486.32944	391.89691
01-Apr-03 18:29:00	192316.21406	391.42706
01-Apr-03 18:31:00	190566.78918	391.22134
01-Apr-03 18:33:00	189344.31544	391.13818
01-Apr-03 18:35:00	187232.85381	392.72498
	199694.12251	390.84991

U1B 50%

31-Mar-03 08:25:00	FLOW	TEMP
31-Mar-03 09:03:00	1COAXI057/	1COAXI201A
31-Mar-03 08:25:00	39278.32434	304.29608
31-Mar-03 08:27:00	39143.35490	301.90692
31-Mar-03 08:29:00	39333.66996	307.16913
31-Mar-03 08:31:00	39529.25345	314.26202
31-Mar-03 08:33:00	39724.81883	319.03998
31-Mar-03 08:35:00	39363.14417	317.92682
31-Mar-03 08:37:00	39302.09562	312.03848
31-Mar-03 08:39:00	39437.64441	307.79138
31-Mar-03 08:41:00	39746.90639	307.80893
31-Mar-03 08:43:00	38880.96561	310.05630
31-Mar-03 08:45:00	39708.01781	312.97409
31-Mar-03 08:47:00	38896.02859	314.04395
31-Mar-03 08:49:00	39346.18021	310.81827
31-Mar-03 08:51:00	39187.45759	306.11243
31-Mar-03 08:53:00	38824.51561	304.40720
31-Mar-03 08:55:00	38469.14133	307.92862
31-Mar-03 08:57:00	38192.41324	313.41489
31-Mar-03 08:59:00	37936.61401	312.65958
31-Mar-03 09:01:00	37680.81477	309.63541
	189051.65057	310.22581

U1B 75%

31-Mar-03 09:28:00	FLOW	TEMP
31-Mar-03 10:15:00	1COAXI057A	1COAXI201/
31-Mar-03 09:28:00	213545.03382	345.8334
31-Mar-03 09:30:00	214483.80922	349.5365
31-Mar-03 09:32:00	214466.64610	352.8045
31-Mar-03 09:34:00	214331.16973	361.3631
31-Mar-03 09:36:00	213992.50596	372.8296
31-Mar-03 09:38:00	214453.75566	384.9017
31-Mar-03 09:40:00	213793.33777	395.8202
31-Mar-03 09:42:00	214107.30693	408.3808
31-Mar-03 09:44:00	214286.43338	428.3553
31-Mar-03 09:46:00	214723.44109	442.3254
31-Mar-03 09:48:00	212681.86304	428.3436
31-Mar-03 09:50:00	219070.76072	282.0051
31-Mar-03 09:52:00	215637.03305	160.4086
31-Mar-03 09:54:00	215709.77715	138.9516
31-Mar-03 09:56:00	210910.71270	253.4142
31-Mar-03 09:58:00	213512.01112	367.0570
31-Mar-03 10:00:00	212982.86934	400.1602
31-Mar-03 10:02:00	173075.60012	375.5010
31-Mar-03 10:04:00	762.97587	332.9123
31-Mar-03 10:06:00	755.68151	302.2134
31-Mar-03 10:08:00	748.38714	281.4931
31-Mar-03 10:10:00	741.09263	263.4098
31-Mar-03 10:12:00	733.79826	248.4315
	214310.64158	345.1414

IP7_040157

U1C 50%			U1C 75%			U1C 90%		U1D 50%
FLOW	TEMP	31-Mar-03 12:40:00	FLOW	TEMP	31-Mar-03 13:40:00 FLOW	TEMP		
1COAXI058A	1COAXI202A	31-Mar-03 13:20:00	1COAXI058A	1COAXI202A	31-Mar-03 14:20:00 1COAXI058/	1COAXI202A		1COAXI059/
78187.90955	303.40778	31-Mar-03 12:40:00	202496.25950	350.68155	31-Mar-03 13:40:00)2778.32844	353.87213	31-Mar-03 18:09:00	187433.19
78432.06755	304.33725	31-Mar-03 12:42:00	201062.75908	350.48856	31-Mar-03 13:42:0027496.69221	355.45129	31-Mar-03 18:11:00	187740.07
78676.24366	306.08865	31-Mar-03 12:44:00	201238.98880	350.89246	31-Mar-03 13:44:0030809.40904	357.07550	31-Mar-03 18:13:00	187105.08
78920.41977	307.85153	31-Mar-03 12:46:00	201410.14925	353.18112	31-Mar-03 13:46:0031240.46035	356.61603	31-Mar-03 18:15:00	187060.46
79164.57777	308.75858	31-Mar-03 12:48:00	201444.65652	355.70731	31-Mar-03 13:48:0031564.36891	355.75760	31-Mar-03 18:17:00	187152.23
79408.71767	309.18887	31-Mar-03 12:50:00	200933.96329	357.69034	31-Mar-03 13:50:0031888.27747	355.58398	31-Mar-03 18:19:00	187103.55
79652.89378	308.59201	31-Mar-03 12:52:00	201209.56890	357.17380	31-Mar-03 13:52:0032207.24349	355.69052	31-Mar-03 18:21:00	187145.95
78243.25517	307.63049	31-Mar-03 12:54:00	201270.12863	356.40186	31-Mar-03 13:54:0032317.46401	355.82877	31-Mar-03 18:23:00	187393.91
78743.26672	306.53995	31-Mar-03 12:56:00	200955.10941	355.07266	31-Mar-03 13:56:0032317.46401	357.09802	31-Mar-03 18:25:00	187039.13
78735.91627	303.84634	31-Mar-03 12:58:00	201435.18784	353.56467	31-Mar-03 13:58:0032839.59933	358.01477	31-Mar-03 18:27:00	187277.71
78728.54771	302.47552	31-Mar-03 13:00:00	201165.52052	352.99332	31-Mar-03 14:00:0032455.96384	358.01477	31-Mar-03 18:29:00	187132.69
78721.17916	303.73428	31-Mar-03 13:02:00	201406.90853	352.99332	31-Mar-03 14:02:0031697.45548	358.10519	31-Mar-03 18:31:00	187396.03
78713.82871	306.43539	31-Mar-03 13:04:00	201293.59213	353.18994	31-Mar-03 14:04:0031443.39429	358.39877	31-Mar-03 18:33:00	186912.09
78706.47826	308.96201	31-Mar-03 13:06:00	200567.14693	354.29974	31-Mar-03 14:06:0031735.80093	358.77264	31-Mar-03 18:35:00	186622.78
78699.10971	309.97009	31-Mar-03 13:08:00	201515.93415	355.26642	31-Mar-03 14:08:0032695.77676	359.20908	31-Mar-03 18:37:00	187470.27
78691.75926	310.25647	31-Mar-03 13:10:00	201443.66077	354.78326	31-Mar-03 14:10:0032365.98421	358.27786	31-Mar-03 18:39:00	187612.95
78684.39071	310.19495	31-Mar-03 13:12:00	200879.93930	354.07428	31-Mar-03 14:12:0031624.60276	358.01480	31-Mar-03 18:41:00	187340.99
78677.04026	309.88992	31-Mar-03 13:14:00	200931.77264	353.36530	31-Mar-03 14:14:0030459.59286	358.40082	31-Mar-03 18:43:00	187150.64
78669.67171	308.55334	31-Mar-03 13:16:00	201201.51237	352.66061	31-Mar-03 14:16:0033402.79577	360.23965	31-Mar-03 18:45:00	187158.80
78662.32126	306.88681	31-Mar-03 13:18:00	200993.03844	352.67593	31-Mar-03 14:18:0032397.08784	358.44739	31-Mar-03 18:47:00	186843.08
78654.97081	304.17715						31-Mar-03 18:49:00	187118.55
								187200.48
78751.16978	307.03702							
			201242.78985	353.85782	230286.88810	357.34348		

IP7_040158

		U1E 50%			U1E 90%			U1F 50%	
TEMP	01-Apr-03 16:46:00	FLOW	TEMP	01-Apr-03 15:21:00	FLOW	TEMP	01-Apr-03 08:55:00	FLOW	TE
1COAXI203A	01-Apr-03 17:20:00	1COAXI060A	1COAXI204A	01-Apr-03 15:55:00	1COAXI060A	1COAXI204A	01-Apr-03 09:33:00	1COAXI061A	1C
344.77786	01-Apr-03 16:46:00	85705.37266	285.84100	01-Apr-03 15:21:00	21744.74892	338.50604	01-Apr-03 08:55:00	95407.25874	37
358.68927	01-Apr-03 16:48:00	85651.20383	287.71658	01-Apr-03 15:23:00	25372.82896	345.31506	01-Apr-03 08:57:00	87472.82967	35
369.06366	01-Apr-03 16:50:00	85597.03501	291.60138	01-Apr-03 15:25:00	24880.34891	353.74960	01-Apr-03 08:59:00	86506.84312	32
375.36734	01-Apr-03 16:52:00	85542.82998	294.71436	01-Apr-03 15:27:00	25399.29782	362.16599	01-Apr-03 09:01:00	85608.11500	30
377.29669	01-Apr-03 16:54:00	85488.66116	294.96838	01-Apr-03 15:29:00	26197.88966	368.71680	01-Apr-03 09:03:00	85532.54659	29
374.98392	01-Apr-03 16:56:00	85434.49233	292.56332	01-Apr-03 15:31:00	26579.75090	371.24136	01-Apr-03 09:05:00	85484.89541	28
370.69379	01-Apr-03 16:58:00	85380.32351	290.04910	01-Apr-03 15:33:00	26925.76512	368.58643	01-Apr-03 09:07:00	84540.47139	29
365.58118	01-Apr-03 17:00:00	84946.71946	287.81375	01-Apr-03 15:35:00	26672.19275	363.05566	01-Apr-03 09:09:00	83439.80508	30
361.13147	01-Apr-03 17:02:00	85921.93932	287.10141	01-Apr-03 15:37:00	25060.65215	357.47305	01-Apr-03 09:11:00	86625.77193	30
357.56018	01-Apr-03 17:04:00	85996.83786	286.87836	01-Apr-03 15:39:00	27665.02834	355.35074	01-Apr-03 09:13:00	86906.10284	30
357.50012	01-Apr-03 17:06:00	86071.73640	287.85925	01-Apr-03 15:41:00	28673.65111	356.40842	01-Apr-03 09:15:00	86772.99816	30
358.37637	01-Apr-03 17:08:00	86146.63493	289.25	01-Apr-03 15:43:00	27201.20779	359.35712	01-Apr-03 09:17:00	86639.87538	29
359.41165	01-Apr-03 17:10:00	86221.51537	290.71262	01-Apr-03 15:45:00	26160.50376	362.34326	01-Apr-03 09:19:00	86506.77071	29
356.61682	01-Apr-03 17:12:00	86296.41390	292.01495	01-Apr-03 15:47:00	26674.22046	364.87094	01-Apr-03 09:21:00	86373.66603	30
352.82336	01-Apr-03 17:14:00	86371.33054	292.53680	01-Apr-03 15:49:00	27642.63301	366.24588	01-Apr-03 09:23:00	86240.56136	30
352.53339	01-Apr-03 17:16:00	86446.21098	292.96039	01-Apr-03 15:51:00	27654.92600	367.29300	01-Apr-03 09:25:00	86107.45668	30
352.53336	01-Apr-03 17:18:00	86521.10951	293.38394	01-Apr-03 15:53:00	27285.14050	367.18698	01-Apr-03 09:27:00	85974.35201	30
352.53336							01-Apr-03 09:29:00	85863.09953	30
352.53336							01-Apr-03 09:31:00	86204.82297	30
352.81760									
353.38721									
352.53830									
352.02762									
350.15668									
358.78894		185867.08040	290.46857		226340.63448	360.46273		186537.27593	30

IP7_040159

	U1G 50%			U1G 50%	
01-Apr-03 11:03:00	FLOW	TEMP	01-Apr-03 10:15:00	FLOW	TEMP
01-Apr-03 11:37:00	1COAXI062/	1COAXI206A	01-Apr-03 10:50:00	1COAXI062A	1COAXI206A
01-Apr-03 11:03:00	90050.84563	296.27756	01-Apr-03 10:15:00	28203.14998	363.25681
01-Apr-03 11:05:00	39914.35540	293.57034	01-Apr-03 10:17:00	28183.61517	367.48557
01-Apr-03 11:07:00	39777.88328	298.38104	01-Apr-03 10:19:00	28160.45944	373.46381
01-Apr-03 11:09:00	39641.37495	306.27304	01-Apr-03 10:21:00	28085.16261	379.06537
01-Apr-03 11:11:00	39504.90282	311.50012	01-Apr-03 10:23:00	28017.46968	381.88925
01-Apr-03 11:13:00	39367.74273	312.16721	01-Apr-03 10:25:00	28142.78940	381.48737
01-Apr-03 11:15:00	38940.76495	309.40833	01-Apr-03 10:27:00	27832.56788	379.64059
01-Apr-03 11:17:00	38274.91569	305.74094	01-Apr-03 10:29:00	28619.53660	377.47214
01-Apr-03 11:19:00	38400.01815	303.10938	01-Apr-03 10:31:00	28825.60262	375.50232
01-Apr-03 11:21:00	39391.29675	301.97333	01-Apr-03 10:33:00	28681.47227	374.03464
01-Apr-03 11:23:00	38916.99367	300.97479	01-Apr-03 10:35:00	28311.07122	374.19666
01-Apr-03 11:25:00	38434.95994	301.28009	01-Apr-03 10:37:00	28453.71700	375.08389
01-Apr-03 11:27:00	38149.27009	301.95322	01-Apr-03 10:39:00	28626.45254	376.09680
01-Apr-03 11:29:00	38386.11385	303.32135	01-Apr-03 10:41:00	28373.20605	377.15826
01-Apr-03 11:31:00	38651.21883	304.95035	01-Apr-03 10:43:00	28136.21745	378.04453
01-Apr-03 11:33:00	38916.34190	305.09116	01-Apr-03 10:45:00	27899.19263	377.63748
01-Apr-03 11:35:00	39181.46498	304.48975	01-Apr-03 10:47:00	27662.16782	376.96866
	189052.96845	303.55659		228247.87355	375.79318

IP7_040160

U1 PA FLOW TRAVERSE TEST CCS PI AVERAGES - 31MAR03 & 1 APR03

	U1A 90%			U1B 50%			U1B 75%
712.74931	FLOW	TEMP	37711.35069	FLOW	TEMP	37711.39444	FLOW
712.77639	1COAXI05	1COAXI200A	37711.37708	1COAXI05	1COAXI201A	37711.42708	1COAXI05
712.74931	601.05930	336.23932	37711.35069	278.32434	304.29608	37711.39444	545.03382
712.75069	365.36423	350.24170	37711.35208	143.35490	301.90692	37711.39583	483.80922
712.75208	736.50758	370.55420	37711.35347	333.66996	307.16913	37711.39722	466.64610
712.75347	976.96226	386.30789	37711.35486	529.25345	314.26202	37711.39861	331.16973
712.75486	001.56946	397.94345	37711.35625	724.81883	319.03998	37711.4	992.50596
712.75625	114.17478	404.38211	37711.35764	363.14417	317.92682	37711.40139	453.75566
712.75764	723.48475	407.52591	37711.35903	302.09562	312.03848	37711.40278	793.33777
712.75903	704.23084	407.19937	37711.36042	437.64441	307.79138	37711.40417	107.30693
712.76042	526.73069	406.05521	37711.36181	746.90639	307.80893	37711.40556	286.43338
712.76181	222.12846	405.25162	37711.36319	880.96561	310.05630	37711.40694	723.44109
712.76319	125.75293	404.50192	37711.36458	708.01781	312.97409	37711.40833	681.86304
712.76458	966.50340	401.23434	37711.36597	896.02859	314.04395	37711.40972	070.76072
712.76597	367.86635	396.83533	37711.36736	346.18021	310.81827	37711.41111	637.03305
712.76736	809.49072	393.46747	37711.36875	187.45759	306.11243	37711.4125	709.77715
712.76875	486.32944	391.89691	37711.37014	824.51561	304.40720	37711.41389	910.71270
712.77014	316.21406	391.42706	37711.37153	469.14133	307.92862	37711.41528	512.01112
712.77153	566.78918	391.22134	37711.37292	192.41324	313.41489	37711.41667	982.86934
712.77292	344.31544	391.13818	37711.37431	936.61401	312.65958	37711.41806	075.60012
712.77431	232.85381	392.72498	37711.37569	680.81477	309.63541	37711.41944	762.97587
						37711.42083	755.68151
	199694.12251	390.84991				37711.42222	748.38714
						37711.42361	741.09263
						37711.425	733.79826
				189051.65057	310.22581		
							214310.64158

	U1B 90%			U1C 50%		
TEMP	37711.70625	FLOW	TEMP	37711.66181	FLOW	TEMP
1COAXI201A	37711.73611	1COAXI05	1COAXI201A	37711.69097	1COAXI05	1COAXI202A
345.83347	37711.70625	012.09763	363.40012	37711.66181	187.90955	303.40778
349.53650	37711.70764	968.90016	364.81723	37711.66319	432.06755	304.33725
352.80450	37711.70903	318.87928	365.47687	37711.66458	676.24366	306.08865
361.36316	37711.71042	024.89754	366.14334	37711.66597	920.41977	307.85153
372.82965	37711.71181	623.41097	366.81439	37711.66736	164.57777	308.75858
384.90176	37711.71319	081.23891	365.90469	37711.66875	408.71767	309.18887
395.82025	37711.71458	111.83061	365.24365	37711.67014	652.89378	308.59201
408.38080	37711.71597	417.76635	365.06564	37711.67153	243.25517	307.63049
428.35535	37711.71736	145.98080	365.74951	37711.67292	743.26672	306.53995
442.32547	37711.71875	641.66036	365.89444	37711.67431	735.91627	303.84634
428.34360	37711.72014	237.55363	365.06924	37711.67569	728.54771	302.47552
282.00510	37711.72153	462.91411	364.66385	37711.67708	721.17916	303.73428
160.40869	37711.72292	760.65160	363.00565	37711.67847	713.82871	306.43539
138.95161	37711.72431	311.57004	360.38687	37711.67986	706.47826	308.96201
253.41428	37711.72569	445.18164	358.45236	37711.68125	699.10971	309.97009
367.05704	37711.72708	624.28499	358.61246	37711.68264	691.75926	310.25647
400.16025	37711.72847	497.98263	359.79453	37711.68403	684.39071	310.19495
375.50101	37711.72986	779.22375	361.81076	37711.68542	677.04026	309.88992
332.91232	37711.73125	021.15490	363.02716	37711.68681	669.67171	308.55334
302.21341	37711.73264	911.54494	364.14310	37711.68819	662.32126	306.88681
281.49313	37711.73403	195.49175	364.75897	37711.68958	654.97081	304.17715
263.40982						
248.43156						
345.14143		229028.29603	363.72547		178751.16978	307.03702

U1C 75%			U1C 90%			U1D 50%	
711.52778	FLOW	TEMP	37711.56944	FLOW	TEMP		
711.55556	1COAXI05	1COAXI202A	37711.59722	1COAXI05	1COAXI202A		1COAXI05
711.52778	496.25950	350.68155	37711.56944	778.32844	353.87213	37711.75625	433.19880
711.52917	062.75908	350.48856	37711.57083	496.69221	355.45129	37711.75764	740.07098
711.53056	238.98880	350.89246	37711.57222	809.40904	357.07550	37711.75903	105.08998
711.53194	410.14925	353.18112	37711.57361	240.46035	356.61603	37711.76042	060.46226
711.53333	444.65652	355.70731	37711.575	564.36891	355.75760	37711.76181	152.23424
711.53472	933.96329	357.69034	37711.57639	888.27747	355.58398	37711.76319	103.55109
711.53611	209.56890	357.17380	37711.57778	207.24349	355.69052	37711.76458	145.95196
7711.5375	270.12863	356.40186	37711.57917	317.46401	355.82877	37711.76597	393.91192
711.53889	955.10941	355.07266	37711.58056	317.46401	357.09802	37711.76736	039.13509
711.54028	435.18784	353.56467	37711.58194	839.59933	358.01477	37711.76875	277.71690
711.54167	165.52052	352.99332	37711.58333	455.96384	358.01477	37711.77014	132.69942
711.54306	406.90853	352.99332	37711.58472	697.45548	358.10519	37711.77153	396.03015
711.54444	293.59213	353.18994	37711.58611	443.39429	358.39877	37711.77292	912.09544
711.54583	567.14693	354.29974	37711.5875	735.80093	358.77264	37711.77431	622.78468
711.54722	515.93415	355.26642	37711.58889	695.77676	359.20908	37711.77569	470.27692
711.54861	443.66077	354.78326	37711.59028	365.98421	358.27786	37711.77708	612.95891
37711.55	879.93930	354.07428	37711.59167	624.60276	358.01480	37711.77847	340.99231
711.55139	931.77264	353.36530	37711.59306	459.59286	358.40082	37711.77986	150.64104
711.55278	201.51237	352.66061	37711.59444	402.79577	360.23965	37711.78125	158.80619
711.55417	993.03844	352.67593	37711.59583	397.08784	358.44739	37711.78264	843.08089
						37711.78403	118.55977
							187200.48804
	201242.78985	353.85782		230286.88810	357.34348		

	U1D 90%			U1E 50%		
	37711.79444	FLOW	TEMP	37712.69861	FLOW	TEMP
1COAXI203A	37711.82778	1COAXI05	1COAXI203A	37712.72222	1COAXI06	1COAXI204A
296.45505	37711.79444	567.98294	344.77786	37712.69861	705.37266	285.84100
292.81003	37711.79583	593.87245	358.68927	37712.7	651.20383	287.71658
295.55652	37711.79722	919.95356	369.06366	37712.70139	597.03501	291.60138
302.45721	37711.79861	643.27978	375.36734	37712.70278	542.82998	294.71436
310.30325	37711.8	723.30690	377.29669	37712.70417	488.66116	294.96838
315.21597	37711.80139	230.41044	374.98392	37712.70556	434.49233	292.56332
315.48227	37711.80278	233.58373	370.69379	37712.70694	380.32351	290.04910
311.99863	37711.80417	551.07829	365.58118	37712.70833	946.71946	287.81375
308.46530	37711.80556	819.36466	361.13147	37712.70972	921.93932	287.10141
305.99521	37711.80694	916.83147	357.56018	37712.71111	996.83786	286.87836
306.38531	37711.80833	402.04660	357.50012	37712.7125	071.73640	287.85925
307.48895	37711.80972	006.84231	358.37637	37712.71389	146.63493	289.25
309.57928	37711.81111	453.44854	359.41165	37712.71528	221.51537	290.71262
310.61621	37711.8125	109.87532	356.61682	37712.71667	296.41390	292.01495
309.71545	37711.81389	655.24377	352.82336	37712.71806	371.33054	292.53680
307.41144	37711.81528	487.96581	352.53339	37712.71944	446.21098	292.96039
305.13690	37711.81667	446.38465	352.53336	37712.72083	521.10951	293.38394
305.59763	37711.81806	992.28625	352.53336			
308.47162	37711.81944	646.05977	352.53336			
312.08572	37711.82083	224.31420	352.81760			
314.05954	37711.82222	221.50300	353.38721			
	37711.82361	259.73981	352.53830			
307.20417	37711.825	208.64188	352.02762			
	37711.82639	873.58215	350.15668			
		226882.81660	358.78894		185867.08040	290.46857

IP7_040164

U1E 90%
712.63958 FLOW TEMP
712.66319 1COAXI061 COAXI204A
712.63958 744.74892 338.50604
712.64097 372.82896 345.31506
712.64236 880.34891 353.74960
712.64375 399.29782 362.16599
712.64514 197.88966 368.71680
712.64653 579.75090 371.24136
712.64792 925.76512 368.58643
712.64931 672.19275 363.05566
712.65069 060.65215 357.47305
712.65208 665.02834 355.35074
712.65347 673.65111 356.40842
712.65486 201.20779 359.35712
712.65625 160.50376 362.34326
712.65764 674.22046 364.87094
712.65903 642.63301 366.24588
712.66042 654.92600 367.29300
712.66181 285.14050 367.18698

226340.63448 360.46273

U1F 50%
37712.37153 FLOW TEMP
37712.39792 1COAXI061 COAXI205A
37712.37153 407.25874 379.24521
37712.37292 472.82967 355.34348
37712.37431 506.84312 325.96848
37712.37569 608.11500 302.20621
37712.37708 532.54659 290.32858
37712.37847 484.89541 288.29785
37712.37986 540.47139 293.72449
37712.38125 439.80508 301.02127
37712.38264 625.77193 306.80557
37712.38403 906.10284 306.12592
37712.38542 772.99816 302.34787
37712.38681 639.87538 299.54678
37712.38819 506.77071 299.60809
37712.38958 373.66603 300.59311
37712.39097 240.56136 302.43509
37712.39236 107.45668 304.40173
37712.39375 974.35201 306.36774
37712.39514 863.09953 307.30252
37712.39653 204.82297 307.30252

186537.27593 309.41961

U1F 50%
37712.33056 FLOW
37712.36458 1COAXI06
37712.33056 249.53008
37712.33194 518.89462
37712.33333 886.46636
37712.33472 795.18820
37712.33611 442.61202
37712.3375 285.10241
37712.33889 840.72615
37712.34028 687.54353
37712.34167 877.40909
37712.34306 057.81285
37712.34444 826.98979
37712.34583 443.86623
37712.34722 054.49972
37712.34861 249.76232
37712.35 823.41320
37712.35139 318.01149
37712.35278 702.60651
37712.35417 409.42138
37712.35556 193.69252
37712.35694 657.72533
37712.35833 239.00322
37712.35972 373.98577
37712.36111 351.30576
37712.3625 606.67049

222328.84329

		U1G 50%			U1G 50%	
TEMP	37712.46042	FLOW	TEMP	37712.42708	FLOW	TEMP
1COAXI205A	37712.48403	1COAXI06	1COAXI206A	37712.45139	1COAXI06	1COAXI206A
380.24933	37712.46042	050.84563	296.27756	37712.42708	203.14998	363.25681
382.10062	37712.46181	914.35540	293.57034	37712.42847	183.61517	367.48557
384.54962	37712.46319	777.88328	298.38104	37712.42986	160.45944	373.46381
387.09485	37712.46458	641.37495	306.27304	37712.43125	085.16261	379.06537
389.94174	37712.46597	504.90282	311.50012	37712.43264	017.46968	381.88925
391.15213	37712.46736	367.74273	312.16721	37712.43403	142.78940	381.48737
391.15213	37712.46875	940.76495	309.40833	37712.43542	832.56788	379.64059
391.15213	37712.47014	274.91569	305.74094	37712.43681	619.53660	377.47214
391.04041	37712.47153	400.01815	303.10938	37712.43819	825.60262	375.50232
390.76102	37712.47292	391.29675	301.97333	37712.43958	681.47227	374.03464
390.47983	37712.47431	916.99367	300.97479	37712.44097	311.07122	374.19666
390.19870	37712.47569	434.95994	301.28009	37712.44236	453.71700	375.08389
390.03650	37712.47708	149.27009	301.95322	37712.44375	626.45254	376.09680
391.01837	37712.47847	386.11385	303.32135	37712.44514	373.20605	377.15826
392.22327	37712.47986	651.21883	304.95035	37712.44653	136.21745	378.04453
392.37097	37712.48125	916.34190	305.09116	37712.44792	899.19263	377.63748
392.14334	37712.48264	181.46498	304.48975	37712.44931	662.16782	376.96866
391.91565						
391.68799						
391.46036						
391.23260						
391.00494						
390.77750						
390.69955						
389.85181		189052.96845	303.55659		228247.87355	375.79318

From: <fpalacios@babcockpower.com>
To: "Ken Nielson" <KENNETH-N@ipsc.com>
Date: 1/21/2004 11:22 AM
Subject: Re: E-mail test from Intermountain Power

Ken,
I received theis e-mail with the attachment. I have not review it as yet but want to let you know that this time the e-mail went through OK

"Ken Nielson"
<KENNETH-N@ipsc.c
om>
To
<fpalacios@babcockpower.com>
01/21/2004 11:40
cc
AM
Subject
E-mail test from Intermountain
Power

Francisco,
The re-send of the scanned files failed. It may be too large. So, I am sending the files in three separate e-mails in a compressed format. Please reply if you get this so I know it was received.

Note: I have included the text from the original e-mail below. I will update the other the sketch on the tubing before I send it.

As a reference, I am sending the three *.TIF files that are scanned images of the field sketches of some of the things we discussed this morning.

One file shows the layout or spacing of the ports needed in for the OFA duct. The dimensions are based on the Unit 1 duct height at the location of installation. As we discussed, a big concern is access interference to the ports with traverse probes. 2" diameter, schedule 40 pipe, approximately 12" in length with course threaded caps were used for the port nipples.

One file shows a rough sketch of the dimensions of the tubing route from the feeder duct volu-probe to CAMS panel. One thing that is not shown here is the flex-connection lengths. There will be upwards of 12" of movement of anything secured to the duct from its cold position; hence, the flex-tubing pieces need to be long enough to accommodate this movement without stressing the rigid tubing sections. The position/location of the U2 CAMS panels are expected to be approximately the same as U1; but, there are some minor differences due to piping and other minor obstructions at each location. That may cause some differences in the field fab. tubing lengths from what is shown on this sketch for U1. On the structural drawings on the 9th level, there are vertical structural columns located about 20' out from the boiler corners at 45 deg. through the corner. The CAMS panels will be located on or to the immediate side of these columns as was done on U1.

The other file is a sketch of access ports field fabricated to allow access to the OFA port volu-probes. The dimensions show 10" x 10". These hatches should be large enough to accommodate removal of the volu-probes and tool access for personnel doing the work if they must be removed for maintenance later. These hatches must be located immediately above and centered over the port volu-probes. They must be bolt down with a high-temp gasket seal (+750 deg). Also, they will need to have removable insulation caps placed over the hatches during normal operation.

Please review these and ensure that TEI drawings and materials lists include these items.

Please call on this or any other items on which you have questions.

Thanks,
Ken

Kenneth M. Nielson, P.E.
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Intermountain Power
Delta, UT 84624
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Fax: (435)864-0737
kenneth-n@ipsc.com
[attachment "OFA duct Traverse Port spacing.pdf" deleted by Francisco Palacios/babcockpower]

From: "Gregory Stark" <GStark@Jordancontrols.com>
To: "Ken Nielson" <KENNETH-N@ipsc.com>, <fpalacios@bbpwr.com>
CC: "Canner Associates Inc' 'Joel Casaubon ('Joel Casaubon, Canner Associate...
Date: 5/13/2003 3:05 PM
Subject: RE: ETA on Replacement Jordan Drives

Ken:

The actuators are scheduled to ship from Jordan on June 6, 2003, to Intermountain Power, Delta, UT.

Reference Jordan sales order # 70889-1.

Please feel free to call with any questions or if you require additional assistance.

Regards, Greg Stark

Phone: 414-461-9200 ext. 260
Fax: 414-461-1024
E-mail: Gstark@jordancontrols.com

-----Original Message-----
From: Ken Nielson [mailto:KENNETH-N@ipsc.com]
Sent: Tuesday, May 13, 2003 3:53 PM
To: fpalacios@bbpwr.com; Gregory Stark
Subject: ETA on Replacement Jordan Drives

Gentlemen:
I am checking on the status of the Jordan Series 5200 drives that were ordered for Intermountain Power by BPI. These will be installed as replacements for the 5100 series installed Over Fire Air 1/3 dampers.

What is the status of those drives and what is the estimated delivery schedule? This information will help us ensure that we can have the equipment and manpower scheduled to expedite their installation, once received.

Thanks,
Ken Nielson

Kenneth M. Nielson, P.E.
Lead Engineer, Technical Services
Intermountain Power
Delta, UT 84624
Phone: (435) 864-6437
Fax: (435)864-0737
kenneth-n@ipsc.com

From: Ken Nielson
To: jgielda@babcockpower.com
CC: Phil Hailes
Date: 2/3/2004 5:01 PM
Subject: Re: Fw: 100221-IP2-Test Port Location

Jerry,
I am concerned that both locations will have excessive problems with turbulent flow. The "X" locations are immediately downstream of the OFA feeder dampers. The "O" locations are at a point where the OFA feeder duct is converging. These, plus the closer proximity to the elbow from the supply header to the feeder duct will likely mean excessive turbulence at both locations and greater problems getting good test measurements. On Unit 1, we found extreme stratification in the flows even at a point further downstream. Without turning vanes, I think we would find it worse at the and "O" locations.

Please look at a location further downstream in the feeder duct where turbulence would be minimized and the flow profile is the same as Air Monitor volu-probes. As you did with the locations suggested above, please look for any problems we might have with boiler area structural steel blocking access to the ports with the long test probes. On Unit 1, we encountered some problems with that type of interference and had to relocate the ports.

Thank you for your efforts on this. Please let me know if you have questions this request.

Ken Nielson

Kenneth M. Nielson, P.E.
Lead Engineer, Technical Services
Intermountain Power
Delta, UT 84624
Phone: (435) 864-6437
Fax: (435)864-0737
kenneth-n@ipsc.com

>>> <jgielda@babcockpower.com> 2/3/2004 9:49:48 AM >>>

Ken:

Attached is a drawing showing the location of the test ports.
There are two (2) locations shown, 0's and X's.
Which location do you prefer?

(See attached file: Test-Port-Location.dwg)

Regards

Jerry

----- Forwarded by Jerry Gielda/babcockpower on 02/03/2004 11:47 AM -----

Jerry
Gielda/babcockpow
er To
phil-h@ipsc.com, jim-n@ipsc.com

02/03/2004 10:52 AM
cc
Larry Wise/babcockpower@babcockpower, Larry Boucher/babcockpower@babcockpower
Subject
100221-IP2-Test Port Location

Phil:

Attached is a drawing showing the location of the test ports.
There are two (2) locations shown, 0's and X's.
Which location do you prefer?

(See attached file: Test-Port-Location.dwg)

Please respond ASAP.

Thanks

Jerry

From: Ken Nielson
To: James Nelson
Date: 4/10/2003 7:05 AM
Subject: Re: Fwd: New Jordan Actuator IPSC

No. In talking with BPI on the broken drive, I floated the question about how much a spare would cost. BPI may or may not have a discount that might net a savings for IPSC. I thought it worth while to see. However, the quote below is for a 5100 rather than a 5200.

>>> James Nelson 04/09/03 11:26AM >>>
Is there a reason we need to go through BPI?

>>> <lboucher@bbpwr.com> 04/09/03 09:18AM >>>
Riley Power (BPI) is please to offer for your consideration our firm price of four thousand eight hundred dollars, ($4,800.00) for a spare Jordan Actuator, model SM-5120-N-29/300-D001-F001.

Pricing is firm for thirty (30) days , FOB job site and includes freight.

Delivery is approximately four (4) weeks, however RPI will expedite this as much as possible in an attempt to improve delivery.

I trust this information meets your current needs. Please let me know how IPSC would like to proceed.

Regards

Larry

From: Ken Nielson
To: fpalacios@bbpwr.com
Date: 2/10/2003 5:12 PM
Subject: Re: Instrument location drawing 100210-7-4909-10-00

Francisco:
Thanks this drawing. I will review it as soon as possible.

After reviewing the wiring drawings sent with your previous e-mail, I have a couple of additional questions. The limit switch outputs from the drives are shown as optional. Were they ordered with the drives BPI is providing? If not, do the drives allow adding the limits after installation or must the drives be ordered with them originally?
Thanks,

Ken Nielson
Intermountain Power

>>> <fpalacios@bbpwr.com> 02/10/03 02:17PM >>>
Ken:
I am transmitting the attached Instrument Location drawing for your information. If should have any questions, please let me know.
Francisco

(See attached file: 100210-7490910-00.dwg)

From: <fpalacios@babcockpower.com>
To: <KENNETH-N@ipsc.com>
CC: <JGielda@babcockpower.com>, <LBoucher@babcockpower.com>
Date: 10/1/2003 12:04 PM
Subject: Re: Intermountain Power - Unit 2 OFA controls design information

Ken: This is an attempt to answer your questions. I am only starting this project now and don't have all the answers as yet. However the following is offered:
1.My understanding is that Unit 2 is a duplicate and therefore the recommended controls will remain the same as for Unit 1.
2. Are you referring to position transmitters or a local mechanical position indicator? I take it you mean a local indicator. This option may require a change order, depending on how we priced the units . I'll discuss it with Larry Boucher.
3. A quick check revealed that we intend to design external linkages. We don't know as yet how this will affect the relative location of the drives. I'll follow up on this.
4. I don't' expect any logic changes.

"Ken Nielson"
<KENNETH-N@ipsc.com>
09/30/2003 02:46 PM

To
<fpalacios@bbpwr.com>
cc
"Phil Hailes" <Phil-H@ipsc.com>
Subject
Intermountain Power - Unit 2 OFA controls design information

Francisco,
I am currently assembling the construction package for the controls to be installed with the OFA system on Unit 2. In this process a few questions have come up on the U2 installation. I have listed those below.

1) Will there be any changes to the OFA controls and instrumentation design for Unit 2?

2) Are the same quantity and type (Jordan series 5200) of drives to be installed? Also the 5200s that were installed to replace the 5100s on the 1/3 drives on unit 1 included a position indication. IPSC would like this as well for all unit 2 drives.

3) During our discussions with Larry Boucher following the installation of the Unit 1 OFA system, Larry indicated that BPI was looking at moving the damper control linkage outside of the OFA ducts. Does the OFA design for U2 move the linkage outside the ducts? If so, will the location of the drives remain approximately the same?

4) Will there be any logic changes on the OFA controls design for U2?

Thank you in advance for this information.

Sincerely,

Ken Nielson

Kenneth M. Nielson, P.E.
Lead Engineer, Technical Services
Intermountain Power
Delta, UT 84624
Phone: (435) 864-6437
Fax: (435)864-0737
kenneth-n@ipsc.com

From: <fpalacios@bbpwr.com>
To: <KENNETH-N@ipsc.com>
CC: <BILL-M@ipsc.com>, <Jerry-F@ipsc.com>, <JIM-N@ipsc.com>, <ddorman@bbpwr....
Date: 1/2/2003 6:53 AM
Subject: Re: Intermountain Power. Contract 100210 - Overfire air systemcontrols
Attachments: OFA Control Description.doc

Ken:

I tried to send this e-mail several times on Tuesday. I think your server was probably down or communications could not be established. Here I try again

Thank you for your e-mail of 12/30/2002. For the last couple of weeks we have been busy finalizing the mechanical design and the control philosophy. There are some modifications to my initial understanding of the control strategy after in depth discussions with our process people. Basically, the main difference is that we will not be using the "feeder duct" dampers other than for balancing purposes. The attached control description and basic SAMA explains our thinking. Please review and comment. Also please let me know if this description is sufficient for you to develop the control. Otherwise let me know if you need anything else.
Thank you for your SAMAs. They were a big help in understanding the present controls.

I also hope you had great holidays and wish you a happy new year.

Francisco

(See attached file: OFA Control Description.doc)

From: Andy Chew <achew@airmonitor.com>
To: 'Jerry Finlinson' <Jerry-F@ipsc.com>
CC: Bill Morgan <BILL-M@ipsc.com>, Jon Christensen <JON-C@ipsc.com>, Ken Nie...
Date: 3/2/2004 4:30 PM
Subject: RE: Intermounts PWR OFA CAMS VoluProbe 2SS length (AMC #50600)
Attachments: w50600ab.PDF; 50600a_SPA_R1.pdf

Jerry,

I reviewed the issues with Matt and here are our recommendations.

We think it is acceptable to add the channel to space the VOLU-probe/2SS probes to center the probes in the duct now that it is 4" larger than originally intended. I have attached a revised span data calculation sheet to use in re-programming the flow transmitters. New calibrated span is 0.278 IN w.c. D.P., it was 0.375 IN w.c. D.P. with the 120" x 71" duct. No transducer change appears necessary.

I have attached drawing W50600AB showing the installation of three each VOLU-probe/2SS probes in each of the OFA Feeder ducts on AMC work order number 50600. Note that the number of traverse ports shown on this drawing match the number of flow measurement probes installed. The traverse ports are located less than 24" apart. This coincides with our standard approach of recommending a minimum of one test port every 12" to 24" depending on duct size, physical access to the duct, known flow disturbances, cost to install ports and perform traverse testing per test point etc. In many cases it is not practical to install as many test ports as are calculated in 40 CFR guidelines, but that gives you a place to start from. If we were able to perform traverse testing and successfully characterize flow measurement on the identical unit in the previous OFA installation on AMC WO NO 47791 using only three test ports than we should be able to repeat those same efforts on this unit.

As for expecting most of the flow in the top of the duct is this what you experienced on the previous installation? Hopefully you are using an opposed blade damper upstream of the flow measurement location. Bottom line is more test ports are desirable if you anticipate flow stratification.

Regards,

Andrew Chew
Project Manager
Applications Engineering
Air Monitor Corporation
PH 707-521-1709
FX 707-526-2825

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Tuesday, March 02, 2004 2:12 PM
To: Andy Chew; Matt Maragos
Cc: Bill Morgan; Jon Christensen; Ken Nielson; Phil Hailes
Subject: Intermounts PWR OFA CAMS VoluProbe 2SS length (AMC #50600)

Matt,
As we discussed on the phone today we have a problem with our Overfire air ducts.
There are supposed to be 120 inches wide x 71 inches high, but the manufacturing fab made a mistake and now they are actually 120 x 75. So our question is how to deal with this issue. We have already received the 71 inch 2SS probes.

If you concur, we are considering centering the probes vertically in the duct by adding a 2 inch C channel on the bottom and a 1.5 inch C channel on the top as necessary to adjust the height. This C channel would allow air flow through the support and have minimal flow disturbance. Does that seem reasonable to you. Any reason it would be necessary to get new probes? Of course, we'll need to recalulate the duct area and enter new parameters into the CAMS transmitter.

We need to review the spacing on our test ports. On your dwg W50600AB it states that test ports should be 1 1/4 inch pipe with 3 ports, This would space them out at 23.67 inches apart. But on the Traverse Test Procedure which you sent it says that they should be spaced at 8 inch centers. So how many ports would you recommend on a 75 inch tall duct and at what spacing? Since we are expecting most of the flow in the top half of the duct, we think more ports would give us a more accurate air measurement for calibration.

Would a 1.5 inch diameter test port be preferable? We plan to have test ports on only one side of the duct, since the other side is obstructed.

Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

From: <FPalacios@babcockpower.com>
To: <KENNETH-N@ipsc.com>
Date: 4/16/2003 1:06 PM
Subject: Re: Jordan Drive Requirements for Intermountain Power OFA Dampers

Ken:
I found out that we have already ordered 5 drives, four to replace the 1/3 drives and one your spare. Jordan said it would take three weeks to put them together and one week has gone by. I contacted Jordan and they are adding the local indicators plus increasing the rating to 1000 ft-lbs.

"Ken Nielson"
<KENNETH-N@ipsc.com>
To: <fpalacios@bbpwr.com>
cc: <lboucher@bbpwr.com>, "Jerry Hintze" <JERRY-H@ipsc.com>, "James Nelson" <JIM-N@ipsc.com>, "Phil Hailes" <Phil-H@ipsc.com>
04/16/2003 11:05 AM
Subject: Jordan Drive Requirements for Intermountain Power OFA Dampers

Francisco,
Per our phone conversation of today, I am getting back to you on the 5200 drives to be ordered.

My understanding is that you will order five (5) 5200 series drives. Four (4) of these will replace the 5100's on the 1/3 dampers and one (1) is to be our spare drive.

These should be rated for the higher, 1000 ft-lb torque rating.

We want them ordered with the sight window/indicator that shows the drive travel position. It is available from Jordan for an added cost of $120.

As far as limit switches and position feedback, we want that that same as the 5200s that we have. You and I had spoke about the option of ordering the drives with extra limit switches; but, after some discussion here, we have decided won't need extra limit switches beyond what is configured in the current drives.

One additional note: We have had a little trouble yesterday and today with one of the feeder damper drives binding. This seems to have been overcome by manually cranking the drive a couple of turns. Then the drive operates fine until it is parked for a period of time It may be that the 600 ft-lb rating of the drives for the feeder dampers is close to the marginal zone. We will keep you updated if there are further problems.

Let me know if there are concerns or questions with this information or

with the ordering requirements on the new drives.
Thank you for your assistance,
Ken Nielson

Kenneth M. Nielson, P.E.
Lead Engineer, Technical Services
Intermountain Power
Delta, UT 84624
Phone: (435) 864-6437
Fax: (435)864-0737
kenneth-n@ipsc.com

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Date: 4/16/2003 1:06 PM
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"Ken Nielson"
<KENNETH-N@ips To: <fpalacios@bbpwr.com>
c.com> cc: <lboucher@bbpwr.com>, "Jerry Hintze" <JERRY-H@ipsc.com>,
"James
Nelson" <JIM-N@ipsc.com>, "Phil Hailes" <Phil-H@ipsc.com>
04/16/2003 Subject: Jordan Drive Requirements for Intermountain Power OFA
11:05 AM Dampers

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Thank you for your assistance,
Ken Nielson

Kenneth M. Nielson, P.E.
Lead Engineer, Technical Services
Intermountain Power
Delta, UT 84624
Phone: (435) 864-6437
Fax: (435)864-0737
kenneth-n@ipsc.com

From: "Gregory Stark" <GStark@Jordancontrols.com>
To: "Ken Nielson" <KENNETH-N@ipsc.com>
CC: <fpalacios@bbpwr.com>, "Canner Associates Inc' 'Joel Casaubon ('Joel Cas...
Date: 6/19/2003 1:23 PM
Subject: RE: Jordan order # 70889-1 / BBP purchase order # 433413

Ken:

The five SM-5220's shipped from Jordan Controls via CCX on 6/18/03.

CCX tracking # 840-440613

Please feel free to call if you have any questions or if you require additional assistance.

Regards, Greg Stark

Phone: 414-461-9200 ext. 260

Fax: 414-461-1024

E-mail: Gstark@jordancontrols.com

-----Original Message-----
From: Ken Nielson [mailto:KENNETH-N@ipsc.com]
Sent: Thursday, June 19, 2003 2:05 PM
To: Gregory Stark
Subject: Re: Jordan order # 70889-1 / BBP purchase order # 433413

Greg,

Just a follow up message on the drives. Were they shipped on the 13th?
If so, could you send the carrier and shipping number to me.

Thanks,

Ken Nielson

Intermountain Power

Delta, UT

Phone: (435)864-6437

kenneth-n@ipsc.com

>>> "Gregory Stark" <GStark@Jordancontrols.com> 6/10/2003 1:09:37 PM >>>

From: Greg Stark, Applications Engineer, Jordan Controls Inc

Sent: Tuesday, June 10, 2003

To: Intermountain Power Ken Nielson (kenneth-n@ipsc.com)

Subject: Jordan order # 70889-1 / BBP purchase order # 433413

Cc: Babcock Borsig Power Francisco Palacios (fpalacios@bbpwr.com)

Canner Associates Inc' 'Joel Casaubon ('Joel Casaubon, Canner Associates Inc')

Ken:

The five SM-5220's should ship Friday, June 13th.

Please feel free to call if you have any questions, I will send the tracking number late Friday or Monday morning June 16th.

Regards, Greg Stark

Phone: 414-461-9200 ext. 260

Fax: 414-461-1024

E-mail: Gstark@jordancontrols.com

From: <lboucher@bbpwr.com>
To: "Ken Nielson" <KENNETH-N@ipsc.com>
CC: "James Nelson" <JIM-N@ipsc.com>, "Phil Hailes" <Phil-H@ipsc.com>, <csimm...
Date: 4/10/2003 8:24 AM
Subject: Re: New Jordan Actuator IPSC

Ken

I apologize for the incorrect quotation. I was given pricing for the 5100 series actuator from our Purchasing Department and assumed this was correct.

BPI's firm price for a spare, model 5200 Jordan actuator is six thousand six hundred and fifty dollars, ($6,650.00), delivery is approximately 4 weeks. Pricing include freight to the jobsite. Once again BPI will expedite Jordan in an attempt to shorten delivery.

We have already placed a purchase order for this equipment.

Let me know if you have any questions or need additional information.

Larry

"Ken Nielson"
<KENNETH-N@ips c.com>
To: <lboucher@bbpwr.com>
cc: "James Nelson" <JIM-N@ipsc.com>, "Phil Hailes" <Phil-H@ipsc.com>
Subject: Re: New Jordan Actuator IPSC
04/09/2003
07:28 PM

Larry,
Thank you for the quote on the model 5100 drive. However, the immediate need for a spare is on a 2/3 damper drive (which has the broken drive) which is equipped with a model 5200. Please let us know as soon as possible the cost and delivery estimates on that model.

Also, regarding the Jordan 5100 drives, as you may already be aware there is some question as to whether or not the 5100 drive has sufficient torque to operate the 1/3 dampers. We will be running some torque tests on the dampers tomorrow to determine requirements. If undersized, the 5100's will need to be replaced with 5200's. We are working with Dan Coats on this and the bearing issue to determine cause and sizing.

Please call if there are questions or concerns on any of these matters.

Thank you,
Ken Nielson

Kenneth M. Nielson, P.E.
Lead Engineer, Technical Services
Intermountain Power
Delta, UT 84624
Phone: (435) 864-6437

>>> <lboucher@bbpwr.com> 04/09/03 09:18AM >>>
Riley Power (BPI) is please to offer for your consideration our firm
price
of four thousand eight hundred dollars, ($4,800.00) for a spare
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Actuator, model SM-5120-N-29/300-D001-F001.

Pricing is firm for thirty (30) days , FOB job site and includes
freight.

Delivery is approximately four (4) weeks, however RPI will expedite
this as
much as possible in an attempt to improve delivery.

I trust this information meets your current needs. Please let me know
how
IPSC would like to proceed.

Regards

Larry

****
This email and any files transmitted with it are confidential and
intended solely for the use of the individual or entity to whom they
are addressed. If you have received this email in error please notify

From: Ken Nielson
To: lboucher@bbpwr.com
CC: James Nelson; Phil Hailes
Date: 4/9/2003 5:28 PM
Subject: Re: New Jordan Actuator IPSC

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Please call if there are questions or concerns on any of these matters.

Thank you,
Ken Nielson

Kenneth M. Nielson, P.E.
Lead Engineer, Technical Services
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Larry

****